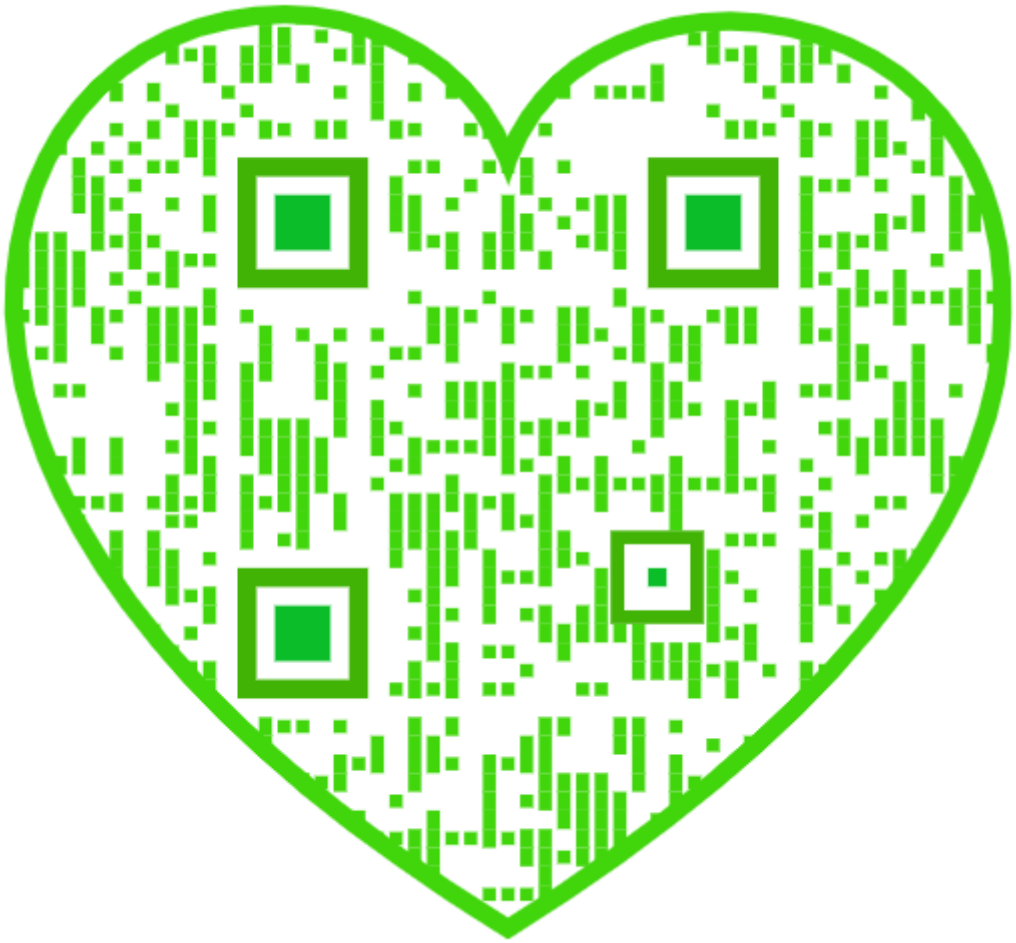

DOMESTIC BOTANY.

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DOMESTIC BOTANY.

AN EXPOSITION

OF THE

STRUCTURE AND CLASSIFICATION OF PLANTS;

AND OF THEIR USES FOR FOOD, CLOTHING, MEDICINE,
AND MANUFACTURING PURPOSES.

BY

JOHN SMITH, A.L.S.

EX-CURATOR OF THE ROYAL BOTANIC GARDENS, KEW.

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"Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat."—GENESIS i. 29.

PREFACE.

MY long official connexion with the Royal Botanic Gardens at Kew has given me the opportunity of becoming acquainted with the views entertained by amateur plant-growers and lovers of flowers regarding the study of Botany.

Many have said they would like to obtain a knowledge of the Structure and Classification of Plants, and with that view have purchased books on the subject; but they so abounded with technical terms and long names difficult to pronounce that they made no progress in the study, and therefore contented themselves with admiring their favourite plants and flowers as pretty objects. Many say they would more readily be induced to learn Botany if all plants had English names; but when it is understood that there are 100,000 kinds of plants now known, the impossibility of giving English names to such a host must be obvious. Scientific words are consequently used, and it should be borne in mind that it is as impossible to study Botany or any other science without learning the meaning of the principal technical terms used, as it is to speak or read a language without a knowledge of its alphabet and grammar. By a little study, scientific terms and names of plants soon become familiar. For instance, the names *Geranium*, *Pelargonium*, *Hydrangea*, *Calceolaria*, *Chrysanthemum*, *Amaranthus*, *Rhododendron*, are now spoken

as freely as if they were original words of our mother-tongue; and there is no reason why the two important botanical words, *Cryptogamia* and *Phænogamia*, should not be equally familiar and as well understood. Many other examples may be given of Greek words being in common use—such as Telegraph, Geography, Thermometer, Barometer, Microscope, Polytechnic, Panorama—and it would require very little practice to call Kew Gardens Phytological Gardens as readily as we speak of the Zoological Gardens* in the Regent's Park. Many say they wish they could reside at Kew for a time, in order to have the opportunity of studying Botany by the examination of the extensive collection of exotics in the Botanic Gardens; this is not, however, necessary, as every garden, field, park, common, road, and river-side affords ample materials for studying Botany. With a view of assisting to remove some of the fancied difficulties, and to render the knowledge of Botany familiar and interesting to those who wish to become acquainted with its principles, without requiring to be taught professionally, I have drawn up an introductory treatise, forming the first part of this work. Although this may be viewed as only a new version of preceding treatises, it nevertheless has this merit, that most of its points have been verified by my own observations. In order to assist in popularizing and showing the practical use of Botany, I have in the second part given a systematic arrangement of the families of plants, briefly describing the principal points of their characters, properties, products, and uses. With regard to the compilation of the economical part, I deem it necessary to state that having early taken an interest in the uses of plants, and assisted in bringing together

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* *Phyton* being the Greek for plant, and *zoon* for animal.

the great collection of vegetable products contained in the Museum at Kew,* I have, from these and other sources, obtained a considerable knowledge of the subject generally known as Economic Botany.

The merit of being the first to collate and systematically arrange this branch of the science is due to the late Dr. Lindley, who, in his great work, "The Vegetable Kingdom," has given a brief account of the principal products and uses of plants under their respective families. This leads me to notice the labours on the same subject of my late son, Alexander Smith, who became connected with the Museum on its first establishment, and ultimately curator. He early conceived the idea of writing a general work on Economic and Commercial Botany, and for that purpose had, at the time of his death in 1865, made an extensive collection of notes, manuscripts for two volumes being then nearly ready for the press. I have been unable to carry out his intentions further than to select matter for the present volume. It is, however, proper to state that, in order to reduce it to a moderate size, it was found necessary to condense as much as possible. In the economic part this has been effected by omitting the notice of species and products of local interest only in foreign countries. This reduction must be accepted as an apology for many brief notices and occasionally abrupt paragraphs; to which must be added, that on account of my recent loss of sight, the whole has been written and arranged from my dictation. Although thus curtailed, I trust, nevertheless, that it will be found to contain sufficient information to make it interesting and instructive to those for whom it is written. It is, however, much to be desired that a general and com-

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* See page 11.

plete work on this subject should be early forthcoming, in furtherance of which it would be well that it met with the same liberal patronage as that given to a work completed last year under the auspices of the Council of Education at South Kensington, for teaching systematic and structural botany only. This great work consists of coloured diagrams, drawn on large sheets of paper, illustrating the characters of about 130 families of plants, each accompanied by a dried specimen of a species typical of the family, with a brief notice of the characters and properties of each. Each sheet, with its specimen, is fixed in a frame for suspension as a picture, seventy of which form a set. One hundred of these sets have been thus prepared.

In order to enable learners to become readily acquainted with the principal organs of plants, I have given a few woodcuts showing the typical forms of flowers and their parts, as also 16 plates by Mr. W. Fitch, exhibiting the natural forms of species characteristic of the classes, not as they grow intermixed in nature, but as scientifically arranged in botanic gardens, by which the eye readily becomes familiar with the aspect of families.

It only remains for me to return thanks to Dr. Hooker for loan of books, to Professor Oliver for special botanic information, and to Robert Heward, F.L.S., and Mr. Jackson, curator of the Kew Museum, for correction of the proof-sheets.

JOHN SMITH.

KEW, *March*, 1871.

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* These characters are accidentally omitted before Apple and Pea Alliance, page 404.

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INTRODUCTION.

THE matters of which the earth is composed, with the objects on its surface and in its waters, are for general purposes classified under three heads or kingdoms—viz., *Mineral*, *Vegetable*, and *Animal*. The first comprehends metals, stones, and all substances devoid of organic structure, without the power of extension or motion, being, if left untouched, the same to-day and for ever. The second consists of plants, which possess an organized structure, endowed with the vital power of extension and reproduction, but devoid of locomotion or apparent sense of feeling pleasure or pain. The third embraces all creatures endowed with life, and a greater or less degree of perception, possessing the power of reproduction and locomotion, with the sense of feeling pleasure and pain. The two latter successively reproduce their like, each generation ultimately decaying. Such is the law of nature. Creative power has been profuse in placing on the earth numerous kinds of plants and animals, furnishing them with organisms suited to their respective habits, all beautiful to behold; but they are often suddenly overtaken by convulsions of the earth, the lofty forest tree and humble herb being overthrown and buried beneath its surface, or hidden under its waters.

That one or more such catastrophes, either universal or local, have occurred at long unknown intervals of time, is evident from the numerous fossil remains and imprints of plants and animals found preserved in various conditions under or on the surface of the earth, such being of remarkable forms and quite distinct from any now living.

It is the purpose of this work, however, to speak only of the plants now living on the earth.

In the Bible we find about one hundred different kinds recorded, with the uses of many of them specified, which with other evidence has enabled us to identify about one-half with plants of the present day, while others remain doubtful.

For many centuries after the close of Bible history the area of the earth known to the civilized nations of Europe, did not extend beyond the countries of Western Asia, Egypt, and the regions around the Mediterranean Sea. But since the end of the fourteenth century of the Christian era the middle and eastern countries of Asia, Southern Africa, the continent of America, and the numerous islands of the ocean have been discovered, and thousands of new plants become known. Almost every different country or region, often of limited area, possesses kinds peculiar to itself; nevertheless, some European plants are found common to many distant and widely separated countries.

Much has of late years been written on the geographical distribution of plants and their "aspects in nature," upon which, although of the highest interest in their study, our space only admits of a few brief observations. With the exception of the Polar regions, the snow and ice capped mountains, and the moving Sahara, the earth, "and the waters under the earth," abound with plants.

The grass of the field on which animal life directly or indirectly depends, occupies the greatest area, and may be called the carpet of the earth. Vast plains, known in different countries by the names of steppes, savannas, and llanos, are covered with fern, heath, and scrub plants, often indicating sterility, but sometimes the contrary, as in the grassy pampas and prairies of America. In northern latitudes large areas are occupied with mosses and lichens, and in temperate and warm zones immense forests form the grand aspects of nature on mountains and plains. Plants also extend their domain by certain kinds growing on others, of which the numerous species of tropical Orchid, Arum, and Pine Apple families, as well as the more humble race of Lichens and Mosses that clothe the forests, are examples; but these only adhere. Another class are what are termed parasites, the Mistletoe being the only special example in this country, though its allies are numerous in tropical countries. Both fresh water and the sea abound in flowerless plants called Algæ, generally known as sea-weeds, which in some places form extensive ocean forests, floating on the surface in such density as to impede, and in some cases prevent the navigation of ships. The last to be noticed are the Fungi, which grow upon and ultimately reduce all dead vegetable substances to their original element, and even prey on the living. Having said thus much of the dispersion of plants over the earth, we have next to consider their most important and necessary use to man as food.

During the first two thousand years of Bible history there is no information of what were the food plants of man until the time of Noah, who "planted a vineyard" and made wine; but it is to be inferred that some kind

of pulse or corn was cultivated in the time of Abraham, as "fine meal," "bread," and "cakes" are then spoken of, and in the time of Jacob, "lentils." Corn and wheat are also mentioned, thus showing that these plants were then grown in the land of Canaan; and history proves that at that period Egypt was a corn-growing country. From that time to the present day, corn and pulse have been the staff of life to a great portion of mankind. The staple food, however, varies much according to the different climates and the hereditary customs of the numerous races of man. In most tropical climates rice, sago, cocoa-nut, banana, tara, quinoa, maize, and in temperate latitudes corn, that is, wheat, oats, barley, and rye are the principal food plants; the potato with other succulent roots and numerous fruits being auxiliaries; while the reindeer and Iceland moss, bark, nuts of various kinds, bulbous roots, and fungi form a great part of the food of more northern nations. The plants yielding tea, coffee, sugar, wine, tobacco, and betel nut, have become special objects of man's care, not as being necessary to his existence, but in order to satisfy artificial or acquired tastes, being generally what are called luxuries, which, from habitual use, have become indispensable to his comfort. It is to be observed that some of the most useful plants are in their natural state highly poisonous, but are rendered wholesome by art. It is, however, to be deplored that by distillation the sugar-yielding plants have become the demoralizing agents of the human race.

The forethought of civilized nations is mainly directed to the production of a constant supply of food, by sowing and reaping according to the nature of their climate and the plants they use. The elements, however, pay no respect

to the works of man, and it often happens that too little or too much rain, or other influences, as mildews and insects, prove injurious to the life of plants and prevent them from coming to maturity, thus causing famine and death to whole districts, as instanced in India in 1866, when thousands of people perished for want of food. Even Great Britain and Ireland, with their highly cultivated fields, are not able to produce sufficient food for the 29,000,000 of inhabitants; a few more rainy days during the harvest of 1866 would have caused a famine.

Tilling, sowing, and reaping, however, are unknown to many races of men, even in the most favourable climates. For instance, New Holland, abounding as it does in forest and grass lands, possesses no native corn, fruit, or roots of sufficient succulency or abundance to form a staple of food for a large population. Hence the wandering habits of the natives, whose vegetable sustenance chiefly depends on fern-root, nardoo, Araucaria nuts, and the like.

Next in importance to food is protection from the vicissitudes of heat and cold. In the broad central zone of the earth where the temperature is such that man requires no artificial protection, except for the hereditary virtue of decency, many races, like our first parents, only sew leaves together, or make use of pieces of bark in the most primitive form, as may be seen from many specimens in the museum at Kew. But in the earliest times of civilization we find that flax was grown in Egypt. Cotton also appears to have been early known, and it is singular that these two substances still continue to supply the materials for the chief articles of clothing. It is not only to insure a regular supply of food and clothing that man is stimulated to till the ground, but

also for the purpose of satisfying the numerous artificial wants which he has created, and which may simply be called ornament, that is, for pleasing the eye in the matter of dress and furniture, or in other ways to add to his comfort or pleasure. To obtain these constitutes a great part of the industry and commerce of the world. Perhaps no plants now conduce more to the progress and civilization of mankind than those yielding gutta-percha and hemp, the former furnishing one of the most important materials for submarine telegraphs, and the latter ropes and sails for ships. Man also finds in plants remedies for his numerous ailments, the most important being opium and quinine, the former mitigating the ravages of cholera, and the latter those of fever.

The foregoing shows the importance of plants for the continuation of animal life on the earth, and it is with no surprise that we find them to have been the study of man in all ages. King Solomon "spake of trees, from the cedar that is in Lebanon to the hyssop that springeth out of the wall;" by which it is reasonable to infer that he had all plants that came under his observation catalogued and classified, and must therefore be considered the first systematic botanist. Horticulture also appears to have been practised in his day, as we read "I made me great works; I builded me houses, I planted me vineyards; I made me gardens and orchards, and I planted trees in them of all kinds of fruit; I made me pools of water, to water therewith the wood [nursery] that bringeth forth trees."* Although these words have only a figurative application, they show that gardening was practised nearly three thousand years ago.

* Ecclesiastes, chap. ii. vers. 4, 5, 6.

As might be expected, it was soon discovered that two or more plants had characters and virtues in common, which led to their being classed in accordance with their relative appearance to each other ; thus came grass, herbs, and trees. The increasing knowledge of man in time led to more defined systems of classification, and the first book extant specially treating of plants is that of Theophrastus, written three hundred and twenty-four years before the Christian era. In that work about seven hundred plants are described, of which about one-half have been identified by modern botanists as natives chiefly of Greece, the descriptions of the other half being too vague to admit of their identification. He was followed by others, now called ancient writers, to describe whose works would form a volume of itself. The classification of these writers was in most cases by dividing the plants into families, according to their likeness to each other, places of growth, or virtues. This system was followed by early writers in this country, such as Turner and Gerard in their herbals—the first published in 1551, and the latter, a thick folio volume, in 1597—in which the descriptions and medical virtues of plants for the cure of all complaints are quaintly set forth. At that period those who collected and cultivated herbs were called *herbalists*, and as they were acquainted with their virtues were looked upon as sages in the healing art.

In the course of time, a knowledge of plants became a necessary part in the education of medical students, and on the establishment of colleges and universities, professors were appointed, whose successive teaching and writings led to the closer study of plants till it became a special science known as botany. It was not, however, until the beginning of the last century that botany began to assume

a scientific character, and in this country, John Ray (1703) may be considered the leader. He was followed by Carol Linnæus, a Swedish professor of botany, who in 1731 published his celebrated sexual system of plants, and as his method was simple and easy it soon became popular and fashionable, doing much for the advancement of botanical science. Although in some degree now superseded by what is called the Jussieuan or natural system,* yet the latter cannot be well understood, or botany learned even by the most scientific, without well studying the elements on which the Linnæan system is founded.

According to Linnæus, all plants are capable of being arranged under twenty-four classes. He was also famed for being the inventor of the trivial or specific name. Before his time names of plants contained their descriptions, often consisting of many words; this Linnæus simplified by giving every plant a name equivalent to the Christian name and surname in a family—the Christian name answering for the species, and the surname for the genus, but reversed in botany; for example, red geranium is *Geranium rubrum.* This method is now adopted by all scientific botanists. During the last sixty years all the principal works on scientific botany have been based on the natural system; and to understand the principles on which it is founded, a knowledge of names, structures, forms, and functions of the different organs of plants is requisite.

I may here notice the origin and important influence which the successive introduction and cultivation of foreign plants known as exotics, has exercised in pro-

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* See Classification.

moting the study of Botany, instances of which are recorded in books of the sixteenth century. In early times, as now, collections of plants were formed by amateurs for pleasure and recreation, or for scientific study; the latter leading to the publication of many botanical works. In time physic gardens were established—that of Oxford and the Apothecaries' Garden at Chelsea being the earliest; from the latter of which issued the botanical and horticultural works of Philip Miller. In 1690 Hampton Court Gardens were patronized as a botanic garden by William III. and Queen Mary, and placed by them under the directorship of the botanist Plukenet. Plukenet sent collectors to distant countries, from whom numerous exotic plants and specimens were received, which furnished him with the materials for his large works on botany. The next important physic garden (botanic) was established at Kew, in 1760, by the Princess of Wales (mother of George III.), assisted by Lord Bute, and placed under the direction of William Aiton, who had studied the Linnæan system and the cultivation of plants under the celebrated Philip Miller (superintendent of the Chelsea Garden). It originally consisted of nine acres, walled in, the Temple of the Sun (still standing) being then about the centre of the garden. Lord Bute was also a great patron and student of botany, on which he wrote an expensive work in nine quarto volumes, only twelve copies of it being printed. At the same period, Dr. (afterwards Sir John) Hill took great interest in the garden, being also a voluminous writer on botany. In 1768 he published a catalogue of the plants of Kew, under the title of "Hortus Kewensis," in which he enumerates three thousand four hundred plants. But the scientific reputation of the garden is

due to Mr. Aiton, under whose superintendence the collection of rare plants became celebrated. In 1789 it contained five thousand five hundred species, as recorded in his edition of "Hortus Kewensis," published in three volumes, under the patronage of George III. This monarch, with the assistance of Sir Joseph Banks, gave great facilities for the introduction of exotic plants, and botanical collectors were sent to various countries, as also to accompany surveying expeditions, by which means a large number of new plants were introduced, and Kew obtained European celebrity for its collections.

In 1813, a second edition of "Hortus Kewensis," in five volumes, appeared, edited by Mr. W. T. Aiton (son of the preceding), when the collection is enumerated as having increased to 9800 species, but on account of many being tropical annuals of a weedy nature, and from want of good accommodation, there was never at any one time that number in the garden. Since that period great additions have been made by special collectors and travellers, but no general catalogue has been published. From various lists, however, about 13,000 have been noted as contained in the garden, the greatest number at any one time being about 11,000. The Kew collection may be fairly said to represent the principal families of the vegetable kingdom, and affords ample materials for the study of botany.

Besides collections of living plants, the preservation of which is not always practicable or convenient, collections of dead ones are also formed, by drying and pressing specimens of plants between sheets of soft absorbing paper, and then fixing them on sheets of white paper, on which is written the name of the plant, its native country,

&c., the whole being systematically arranged for ready reference. Formerly such collections were called a "Hortus siccus," or dry garden, now "Herbarium." Part of the natural history collection of Sir Hans Sloane which laid the foundation of the British Museum, consisted of a Hortus siccus, to which have been successively added the collections made during the voyages of Captain Cook and subsequent explorers, as well as that left by the will of the late Sir Joseph Banks.

Second in importance to the British Museum collection, if not first in regard to number of species, is that of the late Sir William Hooker, which has by purchase lately become the property of the nation. It occupies the whole of the house formerly the residence of the late King of Hanover at Kew. Both these collections are free to the public, that is, to botanists or persons wishing to examine specimens for a special purpose. In connexion with these two herbariums, museums for exhibiting the products of plants have also been formed, those at Kew having been established in 1847, by the late Sir William Hooker, through whose indefatigable zeal, assisted latterly by Dr. Hooker (now director), a most extraordinary collection has been brought together, occupying three large buildings; the whole of the specimens are arranged in their respective families, also named and described, and in many cases their uses illustrated by articles of manufacture. These, with the herbarium, libraries, and living plants form a phytological collection worthy of the nation, which, with the garden and museum collections of Oxford, Cambridge, Edinburgh, and Dublin, as also the herbarium of the Linnæan Society in London, furnish materials for the

history of the plants of all countries.* The Linnæan Society is also famed for possessing the herbarium of Linnæus, which was purchased of his heirs by the late eminent botanist Sir James Edward Smith, and after his death by the Linnæan Society, in 1829, for 3000*l*. This collection consists of 13,000 sheets, of which many are unnamed; allowing for duplicates, the number of species may be estimated at about 10,000. These collections, as a whole, afford ample scope for scientific botanists, as well as amateurs, to obtain a knowledge of plants, and of their uses in domestic economy and commerce. The formation of the above specially noticed collections is due to the united labours of plant collectors, but attended with considerable expense, risk, and even loss of life. Of fifty public, private, and special plant collectors employed during the present century, about twenty-five became victims, chiefly to the effects of climate, to accidents, and to violence from the hands of savages.

What is now stated relates to this country only, for it must be understood that botany is also highly patronized by the principal governments of Europe, as well as by the United States of North America.

The foregoing briefly explains the nature and importance of plants, and the interest man has in studying their properties and classification. The principles on which the latter is founded are explained in the first part of this work; their properties and uses are described in the second part.

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* See Appendix.

DOMESTIC BOTANY.

PART I.

EXPLANATION OF THE PARTS, STRUCTURE, LIFE, ORGANISM, AND CLASSIFICATION OF PLANTS.

THE different forms composing the vegetable kingdom were first brought to the notice of man under three heads—viz., *Trees, Herbs,* and *Grass,** which as a whole were called *Plants*. This word, in its modern application, comprehends all vegetable organisms growing on the earth, from microscopic mildew to the largest of trees; about one hundred thousand different forms are known, each bearing seed after its kind. To name, describe, and classify this vast host, known as the vegetable kingdom, constitutes the science called *Botany ;*† for the study of which a special language has gradually been formed, consisting of 3500‡ technical words, denoting the different nature, form, and structure of the various parts of plants, visible and microscopic. But as the purpose of this work is to endeavour to teach botany to those not conversant with Greek and Latin, I deem it unnecessary to use more than about 200 of these techni-

* Genesis, chap. i.
† From a Greek word, *Botane*, grass, or herbs.
‡ Lindley's "Glossary of Botanical Terms."

cal words, which are explained in the following pages. It must be understood that the subject is to be studied upon the evidence of plants, native or exotic, growing in this country, which to common observation may be classed—1. As *trees*, that is, hard-wooded plants with a single stem of all sizes. 2. *Shrubs*, that is, hard-wooded plants having several stems or much-branched single stems, averaging in height from one to fifteen feet. 3. *Herbs*, plants that produce a flower stem direct from the ground, which after perfecting seed dies; generally known as herbaceous plants. 4. All kinds of *grasses*, including *corn*. 5. *Ferns, mosses, mushrooms*, &c.

The first four of these divisions comprehend all flowering plants called *Phænogams;* the fifth, flowerless plants known as *Cryptogams*, the study of which forms a distinct branch of botany; but I only deem it necessary to notice their general character and nature, as given under their respective families.

The technical terms used in naming and describing the different parts of plants, called their organs, are individually applied to plants of very different natures, and without regard to size. For example, the word *trifoliate* is applied to all plants having three leaflets united, as in clover, strawberry, bramble, and laburnum; a blade of grass an inch in length is *linear*, as are also the long leaves of the sugar-cane. The fruit of the currant is *globose*, so is that of the largest pumpkin. Mathematical terms, as *round, oval, triangular, cylindrical*, &c., must be understood to be used in a comparative sense only; it should also be noted that all the parts or organs are liable to vary in form in plants of the same kind. Many forms do not well agree with general definitions; this is especially the case in *roots, stems*, and *fruits;* some families, such as orchids, require special

terms to define the various forms of their peculiar stems, but which cannot be specially entered upon in this work.

Every separate vegetable growth constitutes a *plant*, and consists of two special parts—viz., *root* and *stem;* the latter bearing leaves and flowers. In describing a plant we speak of the *root, stem, leaf, flower, fruit*, and *seed*, each of which varies in form and size, according to the nature of different plants, and it is a question whether we should commence with the germination of the seed, and trace it through all its stages to the perfect plant, or with the perfect plant, and end by showing how the seed is formed, and the changes it undergoes in coming into life. I adopt the latter, and shall treat the whole subject under four different heads—viz., *Organs of growth, Organs of reproduction, Anatomical structure* and *Vitality*, and *Classification*.

I. ORGANS OF GROWTH.

Roots.

Roots are that part of a plant by which it is attached to the earth, or bodies on its surface; sometimes under or floating in water, or suspended in the air; in all cases increasing in length downwards, and spreading in all directions. They, in conjunction with the leaves, absorb from the earth and air the elements for sustaining the life and forming the numerous substances of plants which chemistry reveals. As might be expected, roots present great variety of form and structure, it sometimes being difficult to determine between root and stem. As a general rule, the greater number increase in length by a continuous extension of fibrous points, according to age thickening backwards, and in large trees becoming woody like the stem.

In the division of plants to which Palms, Aloes, Asparagus, and the Orchis and Arum families belong, they are generally thick and fleshy, retaining their nearly uniform thickness throughout, like cord. More than a dozen terms are used to distinguish the different kinds of roots, but it is only necessary to mention the principal—viz., *filiform* or fibrous, which includes all slender thread-like roots; long, thick, and rope-like, as rhubarb; *fusiform* and *conical* being applied to such as radish, parsnip, &c., which are tap-roots, covered with a fleshy substance, the effects of cultivation. Many similar kinds of fleshy bodies grow not only under, but on the surface of the ground, to which they are attached by true roots, thus imparting to them the nature of stems, such as turnip and beetroot. In general, they are called *bulbous* and *tuberous* roots, which terms are indifferently applied to all such bodies, but the difference between a bulb and tuber has not been well defined. I therefore restrict the term to distinct groups of plants, which with other root growth I classify as follows under the head of

Root-stock Stems.

These comprehend all plants called herbs, known by their leaves and flowers being produced yearly from underground surface buds; or from solid fleshy bodies that seldom rise much above the surface of the ground.

Note.—All words compounded of *corm* or *caul* (from Gk. kormos, Lat. caulis, a stem) have reference to a stem of some kind; the word *caudex* is also a name for stem. Words compounded of *rhiza* refer to some kind of root.

Gemmæcorms (bud-corms) include the greater number of plants known as herbaceous, biennial, and perennial.

Their axis of growth in its simplest state consists of a bud furnished with roots, which multiplies itself by side buds (offsets), forming what is generally called the crown or root-stock. The increase is slow and compact, as in the pæony, Oriental poppy, marshmallow, sea-kale, and rhubarb; or it produces short, or long slender runners, called running-roots, furnished with leaf buds which become perfect plants, for which reason they may more properly be considered underground stems (*sarmenta*), this term being applicable to all plants that increase their domain by running-roots, such as goutweed, mint, dogsbane, nettle, Michaelmas daisy, sarsaparilla, brake fern, and all such like usurpers. The strawberry and window saxifrage are examples of above-ground sarmenta. The runner of the potato is also of the same nature, but instead of the buds growing into leafy stems they become swollen, round, or oblong fleshy tuberous bodies, which ultimately lose their attachment to the stem, and become independent tubers furnished with buds (eyes), which develop into leafy flower stems, each becoming a separate plant, the tuber ultimately decaying. From this it may be considered a metamorphosed stem, and all such are known by the name of *tubers*. The Jerusalem artichoke and ulluco of Peru are of the same nature, as also some other knot-rooted plants of the pea, mint, and umbel families.

In *Achimenes* and others of the *Gloxinia* family, also some figworts, the root stems consist of numerous, generally compact scales, forming oblong, linear, or long slender worm-like bodies, growing on, but more usually under the surface; each scale is a rudimentary bud which in season developes into leaf and flower stems. To this the term *lepicorm* is applied.

Tubercorms consist of a fleshy stem-like body, varying in form from round and nearly flat to globose, oblong, cylindrical or conical, and in size from an inch to three feet in diameter, producing leaves and flower stems from their centre or apex; beet, yam, several kinds of convolvulus, bryony, &c., are underground examples; the above-ground ones are turnip, cyclamen, wild chervil (*Leontice*), several kinds of vine (*Cissus*), fleshy geranium and other plants of like nature, natives of South Africa.

Rhizomat is a term applied to all fleshy roots creeping on or under the surface, and emitting roots from no definite point on their under side, of which some kinds of Begonias and water lilies are examples. This and the preceding terms refer to plants with net-veined leaves only.

Rhizocorm. — The rhizome is a creeping root-stock, its limits of extension being indefinite, producing leaves and flowers from its progressing bud. It is either simple or branched, thick and fleshy as in common iris, sweet flag, and Indian shot (*Canna*); or slender, as in lily of the valley, Solomon's-seal, and part of the Arum family. Many kinds of creeping roots are called rhizomes, but a true rhizome is known by the leaves, when mature, falling away from the stem as by a joint, leaving a round mark or scar, and restrictedly with the following, includes only plants with parallel-veined leaves.

Bulbocorm is a term applied to solid fleshy bodies, generally known as bulbs; they grow erect, and multiply by buds (offsets) from their base or sides, the crocus, gladiolus, belladonna lily, narcissus, and others of the Iris and Amaryllis families being examples, as also the cultivated Taras and other bulb roots of the

Arum and Orchid families. It is generally a simple body, but also often variously lobed, as in some of the Melanth family. The word corm may also be extended to what are called *pseudo-bulbs*, which is applied to the bulb-like and cylindrical stems of many tropical orchids that grow above and under the surface.

Phyllocorm (leaf-corm).—This term is applicable to the bulb of the onion, lily, crown imperial and allies; it differs from the preceding in not being solid, but composed of the bases of leaves more or less firmly overlapping each other;* such being termed coated or *tunicated*, and therefore not a true stem. In these the leaves are *deciduous*. But the term also includes a set of plants with parallel veined *permanent* leaves seated on an erect, short, or very rudimentary axis, the bases in some becoming thickened, swollen, and bulb-like; the stemless American and African aloes, and others of the lily and amaryllis, nearly the whole of the pineapple, anthuriums, and others of the Arum families being examples, also tuft growing (*cæspitose*) grasses, as pampas, tussac, and dogsfoot.

There are many special cases difficult to classify under any of the above terms, of which the singular plant known as Elephant's-foot, or Tortoise plant, is an example. Some botanists describe it as a rhizome, while its erect growth, and its developing flower, stems, and leaves from its apex only, indicate it to be more properly corm. Its congener black bryony, a native of this country, is another example.

Plants growing in fresh water are termed *Aquatics*. In general their root stems agree with the above definitions.

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* See Structure of Stems.

Plants that germinate from seeds and die within a year form no root-stem or bud; all such are called annuals.

Tree Stems.

These comprehend all plants with *permanent* soft or hard wood stems, as represented by trees, shrubs, palms, aloes, &c.

Palmids.—Plants with stems varying from 1 to 150 or more feet in height, with parallel-veined leaves; they are either simple, unbranched, as in most palms, tree Strelitzia, grass trees of Australia, the family of cycads, and tree ferns; or with two or more branches, as dome palm, screw pine, dragon tree, and several of the pine-apple family.

Arbors (trees).—All plants having a single erect stem, bearing a head of branches, are known as trees. They vary from a few to 400 feet in height, and from a few inches to 30 feet in diameter. They are simple cylindrical, or tapering, as in common trees; sometimes fluted, as in the wheel tree; or the lower part forming large buttresses, as in the silk cotton and locust trees of the West Indies. Some have what are called gouty stems, their base or lower portion being thick and swollen, but suddenly contracting to a slender stem or head, resembling a common black bottle; hence the bottle or barrel tree of Australia, while *Adenium obesium*, a native of Aden, represents a champagne bottle. The baobab, or Monkey Bread of Africa, is also remarkable for its swollen lower part, in some instances measuring 80 and 90 feet in girth, and not much more than half that number of feet in height.

Frutices (shrubs) comprehend all plants with several stems, rising from the same base in a spreading direction, forming a bush, such as common laurel, bar-

berry, and lilac; they vary from a few inches to 10 or more feet in height. But under certain conditions some trees become shrubs, and many shrubs assume the character of small trees.

Fruticuls.—A term generally applied to small shrubs with soft-wooded stems, such as the greater part of Acanthus, many of the Gloxinia and Asclepias families, also shrubby begonias, peppers, geraniums, crassulas, fig marigold, &c.

Ampelids (climbers, generally called vines).—This term designates slender stems that trail on or near the ground, as bramble; or climb up trees to which they hold by different kinds of appendages, such as hooked spines, as in roses and climbing palms,—thread-like claws or spiral coils (tendrils), as in the vine, trumpet and passion flowers,—or twisted leafstalks, as in Virgin's bower and the Indian pitcher plant.

Twiners.—This is applied to plants that support themselves by twining round others, forming a firm spiral coil, in many instances reaching to the tops of lofty trees, as woodbine, periploca, Chinese wistaria, as also the herbaceous stems of bindweed, hop, and scarlet-runner. The direction of the ascending spire is in most plants from left to right, but in the scarlet-runner it is from right to left.

Clingers (rooting stems).—This applies to woody stems that trail on the ground or ascend trees, to which they adhere by numerous roots produced from their whole under surface, as ivy, *Bignonia radicans*, numerous kinds of tropical figs, and the New Zealand climbing myrtles, Although these hold firmly to trees, they nevertheless retain their root connexion with the ground, which distinguishes them from an extensive race of plants that

grow and maintain themselves entirely on trees without any connexion with the ground, such being called *epiphytal*, of which the numerous tropical orchids and tillandsias are familiar examples.

Although all climbing and twining plants are considered to have slender flexible stems, many of them in age attain a foot or more in diameter, becoming firm like tree stems. Some assume curious forms; in a species of Himalayan vine the stem is flat and thin, hanging from trees like machinery bands, and in a Brazilian Bauhinia they are broad and bent in a zigzag manner, conveying the idea of stair steps.

There is a set of low plants that grow in tufts, remaining green all the year, of which the pink, carnation, seathrift, saxifrage, sedum, blue and yellow alyssum, and dwarf fig marigold are examples. In gardens they are always ranked with herbaceous plants, but their permanent stems give them more the character of shrubs. I therefore apply to them the term *frutlets*. The evergreen candytuft may be considered to hold an intermediate position between them and hard-wooded shrubs.

Sarcocauls (fleshy stemmed plants).—This term is applied to stems composed of soft succulent matter, generally surrounding a woody centre; the cactus family, African euphorbs and Stapelias afford familiar examples. Plants with this kind of stem are leafless, and often three- four- five- or many-sided, or furrowed; they are also *globose*, *pyramidal*, or *conical*, and are either smooth, as in the melon-shaped euphorb, or prickly, as in the Echinus section of cactæ. *Flagelliform*, or cord-like stems, are represented by the creeping cereus and its allies; some are also perfectly flat and more or less broad.

Stems are called *articulated* when composed of pieces

joined end to end, as in several species of cactus, *Kleinia*, and mistletoe; or of round knobs, like turnip radishes, joined together, as in *Euphorbia globosa*.

Some plants growing in hot, dry places in South Africa, have stems and branches more like petrified objects, or coral, than living plants—*Geranium Burmannii* being an example—and may be compared to pieces of light-green wax candles stuck together in an irregular manner. *Colletia horrida*, a hardy garden shrub, is a singular example of a stem being winged, consisting of woody triangular opposite lobes, alternating at right angles to each other. But the most remarkable plant stem of recent discovery is that of *Welwitschia mirabilis*, which with many of the preceding will be specially noticed under their respective families.

In the cactus family, and many trees and herbs, the stems are often flat and contorted in a crested manner, like the garden cockscomb, all such growths being viewed as monstrosities, and to which the term *fasciated* is applied.

Branches. (Lat. *rami*, Gk. *cladus*.)

Branches are lateral multiplications of the main stem; their nature, relative position to each other, and angles of divergence impart to trees special aspects or phases which are generally very uniform to all trees of the same species growing under similar influences. Their direction varies from erect to horizontal and pendulous, as in the weeping willow and birch. In firs and araucarias they are produced in whorls, some forming a right angle with the stem. In Dammara and some species of Podocarpus they are deciduous, falling away, and leaving a clear scar or mark, giving the character of being attached to the stem by a joint.

The first or main branches are called limbs, the smaller branchlets (*ramules*), and the ultimate twigs (*ramlets*). In the araucaria and arbor-vitæ section of the fir family, the branches consist of numerous ramlets formed of small, firm, close, imbricated scales, which are, with the ramlet, permanent for several years, the latter ultimately falling away entire. To all such leaf-growths the term *thyclads* is applied. In the celery-topped pine of Tasmania (*Phyllocladus*), and its congener of New Zealand, the ramlets are flat and broad, assuming the character of leaves, there being no true leaves.

The stems and branches of many plants are furnished with what may be called weapons of defence, chiefly consisting of prickles and thorns, which are either produced on the bark, or connected with the wood; the first are called *aculei*, and the latter *spines;* but these terms are indifferently applied to prickly and thorny plants in general. They are common to many of the apple, pea, rose, orange, gooseberry, and cactus families, and are either simple and straight as in the gooseberry and hawthorn, curved or hooked as in roses and some palms, forked as in the Natal plum, algarobs, and others of the mimosa family, or branched, as in the honey locust tree of North America, in which they are at least six inches in length, growing in clusters on the stem and main branches, and presenting the appearance of chevaux-de-frise. In the cactus family they vary from hair-like bristles to spikes six or more inches in length, some being flat like swords, others like broad hooks, and of a hard bony nature. In the curious Mexican shrub Fouquiera, the midrib of the leaves is permanent, and becomes a hard stiff spine.

Nettles, loasads, and jatropha are furnished with

stinging bristle hairs, seated on a small vesicle or tubercule containing poisonous fluid, which is ejected on the hairs being pressed, causing irritation when coming in contact with the skin.

Armed plants do not appear to possess any special protection; their fruits are in general accessible to animals, especially birds, and their thorny branches are no protection against being browsed on by quadrupeds. Therefore what appears to be weapons of defence are not so in nature.

Bark. (Lat. *cortex*, Gk. *derma*.)

All parts of plants are invested with a skin, called the *bark* or *rhind*, which in permanent stems thickens with age; in leaves, young stems and branches it is thin and soft, being composed of layers of cells (see Structure) of various forms and natures, the surface of the whole covered with a filmy membrane called the *cuticle*, which with the cells below it forms the outer coat (*epidermis*), the layer next the wood being called *liber*. In old trees, as in the elm, it becomes furrowed; in the oak it is hard and firm, or light as in the cork oak; in the lime it consists of fibrous layers capable of being twisted into ropes; and in the paper birch it separates into sheets like pasteboard, from which boats are made. In some species of Daphne, Melalæuca, and other plants, it consists of numerous layers which readily separate from each other, and form sheets like paper; while that of the lace bark tree of Jamaica is netted, and has been used as a substitute for lace.

The outer bark of some trees separates spontaneously, as in the plane. Palms and their allies have no true bark (see Structure).

Buds. (L. *gemma.*)

Most plants have a periodic season of activity and another of repose. In temperate climates it is ruled by the alternating seasons of heat and cold; in tropical countries by the wet and dry seasons. The change from activity to repose called *hibernating* (wintering) is marked by the ripening of the seeds, fall of the leaves, and formation of buds containing the germs of the future leaves, flowers, and axis of extension of the plant, which by the agency of heat and moisture at the proper season burst into active growth. Buds are formed of thin brown (in the ash, black) scales folded over each other; they are very conspicuous in the horse-chestnut, ash, plane, oak, maple, &c. A bud terminates the branches of all trees and shrubs, being also often produced in the axis of the leaves. When a tree is deprived of its leaves and buds by lopping or otherwise, it has by the vital action of its fluids the power of producing buds from below the bark, through which they are protruded; these are called *adventitious buds.* The buds of many trees, when separated with a small portion of the bark attached, are capable under favourable circumstances of becoming a plant; and by the process of what is called budding they may also be transferred from one plant to another, as commonly practised with rose trees.

Palms, aloes, and many other succulent plants have no true buds, but in many, such as tiger and other lilies, also agaves and ferns, buds called *viviparous* are produced on the flower stems, which under favourable circumstances become plants.

Leaves. (L. *folium*, G. *phyllon*.)

Leaves are flat expansions common to most plants, and are sometimes only in a very rudimental state, or entirely wanting, as in the cactus family and other plants called succulents. They vary from the eighth of an inch to twenty and even thirty* feet in length, and in form and size from a small needle to a complete circular disc, from five to six feet in diameter, as in the Victoria lily. They are either deciduous, that is, ripening and falling to the ground in autumn, being reproduced in the spring, or permanent for two or more years, as in evergreen trees and shrubs. In Araucarias and others of the fir family they are permanent for many years, only losing their vitality with that of the branch or ramlet, as explained under branches.

Leaves perform an important part in the life of plants, and in conjunction with the roots assimilate the different substances absorbed in the sap.

The structure of leaves is *cellular*, the cells containing a matter called *chlorophyll*, which gives them their colour. Although green is the normal tint, there are many departures from it, as in red cabbage, the sombre prince's feather, purple beech and perilla. Others again have the brightest colours, as several species of caladium and begonia; several aroids are quite of a metallic hue. When the colours are mixed, as in holly and aucuba, they are called variegated; some have lines or bars, as the zebra plant; others of the same genus have golden, white and pink stripes; and in the Indian shrub *Graptophyllum hortense*, the variegation resembles caricature

* See index, Large Leaves.

forms of the human face, whence it is known as the caricature plant. Many leaves are lucid and reflect light; some are also in imitation of flowers, as in the common red and blue clary. Leaves are attached to the stem by a footstalk, called the petiole, which is short or long, and in some plants entirely wanting; the leaf is then called *sessile*. They generally have a midrib, which is a continuation of the footstalk, and are traversed by veins (see Structure) containing *vascular* vessels; the whole is enclosed by a skin called the *cuticle*, the upper surface being at a greater or less angle with the zenith, and the under facing downwards. The microscope shows both sides of the leaf, but more especially the under, to have pores, in some instances so numerous that a square inch contains many thousands; these pores are round or oblong, and are called *stomata*, being the inhalers and exhalers of the atmosphere, and equivalent in their action to the breathing pores and lungs of animals. The difference between the upper and under surfaces of leaves is familiar to common observation, but there are exceptions to this rule.

In a great number of the trees and shrubs composing the vegetation of Australia, by a twist of the petiole, the leaves stand vertical, that is, the one edge towards the sky and the other towards the earth, both sides in this case having stomata. In the pretty flowering lily genus, *Alstromeria*, the twist is so great that the true upper side becomes the under.

Leaves in general are thin and soft, being easily crumpled, soon withering when separated from the plant; or tough like leather; or they are hard and stiff, as in the cycad family, and many Australian woody plants; or thick and fleshy, as in aloes and other succulents.

Sometimes they are hollow and closed at the top, as an onion leaf, or in the form of an urn or vase, as in pitcher plants.

Leaves are either *simple* or *compound.* Simple leaves are *linear* when long and narrow and of nearly uniform width, such as grasses; *lanceolate,* when broad at the base, and tapering to a point like a lance, as Adam's needle; *elliptical, oval,* or *oblong,* when longer than broad, with obtuse ends; *ovate,* broader at one end like an egg; *rotund,* round, in the form of a circular disc, as in pennywort, sacred bean, and the Victoria lily. These words are sometimes used conjointly, thus *ovate-lanceolate, ovate-elliptical,* and *oblong-lanceolate,* which denotes that the leaf partakes in some degree of both forms. Leaves tapering to a point are called *acuminate; cordate* (heart-shaped), when lobed at the base in the form of a heart, as in water lilies; *hastate,* when the lobes project like a halbert.

The margins are either entire, or with little blunt projections like teeth, *toothed* or *dentate;* or sharp like a saw, *serrate;* sometimes they are deeply gashed, *laciniated,* as in the artichoke; *pinnatifid,* when the divisions (*lacinæ*) are uniform and divided to near the midrib, as in the common polypod fern. When the margin is but slightly rounded or wavy, it is termed *sinuose;* when waved up and down, undulate or crisped. These terms apply chiefly to *oblong* and *lanceolate* leaves. Those of a roundish form, or as wide as long, are called *deltoid,* when their margins are also entire; *sinuose,* when more or less deeply *laciniated,* the divisions being called *lobes;* when five-lobed they are called *palmate* or hand-like, as in the oriental plane; or *flabellate,* fan-like, having the surface plaited, as in fan palms.

The lobes may be either *entire*, *dentate*, *serrate*, or again *laciniated*, or very much divided, *multifid*, as in parsley.

Compound leaves consist of simple leaves produced from a centre, or on a common footstalk, called *rachis*, and each individual leaflet may be of any of the above forms. The simplest compound leaf is *conjugate*, that is, consisting of two leaves united, as in bean-caper and West Indian locust-tree; it is *trifoliate* when three are united, of which clover and the scarlet-runner are examples; *digitate*, when more than three issue from the same point, as the horse-chestnut; *pinnate* (winged), when there are two or more pairs on a *rachis*, like the pea, bean, and ash; *bipinnate*, *tripinnate*, and sometimes *quadripinnate*, is when the first rachis produces a second, and the second a third, on which the leaflets are borne. The sensitive and umbel plants, with others of the Mimosa tribe, as also the hardy tree *Gymnocladus canadensis* and *Aralia arborea* are examples of the latter.

Whatever may be the form of leaves, whether flat, undulate, or curled in any way, they are either *glabrous*, naked; or *pubescent*, clothed. They are *glabrous* when the skin or cuticle is quite destitute of hairs, or any extraneous covering; they may nevertheless be covered with small rough points, warty tubercules, or stiff spines on both surface and margin. They are *pubescent* when clothed with hairs, wool, or scurf-like covering common to leaves and other organs of plants. This covering is very varied in character; *setose*, when the hairs are stiff like bristles; *pilose* and *villose*, when the hairs are long, soft, and silky; *lanuginose*, when interwoven, forming a woolly, felt-like web; *tomentose*, when short, and so close as to give colour (generally white) to the leaf; *scabrous*, when the surface of the leaf is covered

with small rough hair points, feeling like sand paper; *scurfy*, when covered with minute scurf, easily scraped off, as in pineapple leaves; *lepidote*, when covered with thin scales, generally circular, lying flat on the surface, as in *Elæagnus* and *Deutzia*, such being beautiful objects in the microscope. *Squamæ* is a term for scales when long and pointed, as common to ferns.

Hairs are simple or sometimes forked; in the Malpigh family, the genus *Indigofera* (Indigo) and *Grevillea* (Silk oak), they are attached by their centres, lying flat on the surface of the leaf; or in rays like a star, *stellate*, as in the Mallow family; in *Solanum macranthum* they are raised above the surface and rayed, giving the idea of a turnstile. When the hairs are on the margin of the leaf only, it is called *ciliate* or fringed.

Some leaves bear on their footstalk, margin, or disk, small globular teat- or shield-like bodies, generally of a pale, or brown colour, or even black as in St. John's-wort; they are more or less firm or soft, often viscid, and are called *glands*, sometimes sunk like little pores or pits. The substance of many leaves is full of dots, which are seen by holding a leaf of myrtle, orange, or St. John's-wort between the eye and the light; these are called pellucid glands, or dots, and with the preceding, are characteristic of several natural families.

The position of leaves on the stem is either *alternate*, *opposite*, or in *whorls* of three or more, *verticillate;* or several issuing from, or near the same point, *fasciculate*.

According to rule, the evolution of leaves is alternate, the young unfolding leaf being always in advance, and on one side of the one preceding it; the circuit of the stem being completed by the evolution of every five leaves, which may be readily seen by examination of

young shoots of willow, poplar, or any free growing stem. This applies to net-veined leaved plants only. It is, however, difficult to reconcile *opposite* or *verticillated* with this view, but careful examination shows that in some cases their bases are not in the same plane of attachment. In *Sempervivum* (house-leek), the leaves are so compact and imbricate over each other, that in *S. sabulare* they form a round flat disk; in *Scalyciforme* they are curved inwards, forming a cup. The term *rosette* is applied to plants of this nature, with which is included *Saxifraga pyramidalis* and its allies; all leaves rising direct from the root-stock bud are called *radical.* Leaves are *amplexicaul* (stem clasping), when the bases surround the stem, and when such is the case in opposite leaves, they are called *connate,* as in teazles. In *Crassula perforata* its opposite leaves are so united together, that by a little pressure with the fingers, they can be made to revolve round the stem. It has been stated that succulent stemmed plants, as cactæ, are destitute of leaves, and this is not uncommon in many other plants, as furze, the thorns of which may be considered in place of leaves; true leaves being only occasionally seen. But the most special example of leafless plants is found in a great number of Australian species of Acacia, consisting of trees and shrubs of very different habits, apparently clothed with leaves, varying from needle-like to the breadth of one, two, or three inches, and from four, six, eight, or more inches in length, having a midrib and veins; they are, however, not true leaves, but leaf-stalks (*petioles*) only, as is evident on examining the base of connexion, their margins being vertical, and not in the ordinary horizontal position of leaves. These are called *phyllodæ;* but that they are only leafstalks

is manifest by their bearing true leaves on their margin, which is very common in young plants, and in some cultivated species they continue to be produced for a number of years. In some plants branches are flattened and perform the functions of leaves, as in the species of *Xylophylla* (wood-leaf), small trees, natives of the West Indies, having appendages like leaves, but which bearing flowers and true leaves on their margin (the latter rarely seen), must therefore be considered as branches, though possessing the character of true leaves in not increasing in size as branches.

In many plants, immediately below the attachment of the leaves a little leaf-like appendage is to be seen, which is called the *stipule*. In some it is large and leaf-like, as in many of the Pea family, in others very small and scale-like; its presence or absence forms an important character in determining the affinities of plants.

The plants called ferns have no true leaves, their leaf-like expansions being called *fronds*, and their footstalk *stipes*, which are explained under their families.

The above is a brief explanation of the principal forms and nature of leaves, but it must be understood that there are many special forms that can only be properly described individually, such as the Indian, American, and Australian pitcher-plants, Venus's fly-trap, lattice-leaf, &c., which will be noticed under their respective families.

II. ORGANS OF REPRODUCTION.

Flowers. (*L. flos, G. anthos.*)

The principle of vegetable life is to produce flowers which contain organs for reproducing their kind, and in the majority of plants are developed annually from special

formed buds in many different ways. In herbs they are produced on stems that rise from the root-stock, and in trees and shrubs from buds on the apex, or sides of the stem and branches, often in the axis of the leaves, and even on the leaves, as in butcher's broom.* In deciduous trees and shrubs they usually expand before the leaf-buds, and by their profusion and bright colours form for a brief period the brilliant aspect of nature as presented by our fruit orchards and early-flowering ornamental trees; also by the purple heath and golden flowers of the furze and broom on our commons and hills.

The manner in which flowers are produced is termed the *inflorescence*, and its position and mode of arrangement forms an important feature in the character of plants. Flowers are either produced singly, or two or more together, on a common axis; they are either sessile (stalkless) or furnished with a footstalk called the *peduncle*, which bears from one to many flowers; when more than one, the secondary footstalk of each is called the *pedicel* (a little footstalk).

Many terms are employed to designate the various forms of inflorescence, but for the purpose of this work it will be sufficient to notice the most important, as follows:

Fascicle.—When two or more peduncles, each bearing a single flower, rise from a common centre, as in cherry, apple, pear, and hawthorn.

Capitula.—When a number of flowers, often sessile, are produced on the apex of a peduncle in the form of a compact globose or oblong head, as in onion, clover, teazle, thistle, and sea-thrift.

Umbel.—When the peduncles radiate from a terminal centre and bear on their apex several pedicellate flowers,

* See Lily family.

which from their contiguity, form a close, compact, flat or convex surface like an open umbrella, as in parsley, parsnip, carrot, and the umbel family in general; all such are called *compound umbels;*—a *simple umbel* is when a number of pedicellate flowers rise from a solitary peduncle, as in the ivy.

Cyme.—When the peduncles radiate from a centre, as in the umbel, each bearing a flower on its apex and producing from around its base short pedicels bearing flowers forming small umbels, as in the elder, Guelder rose, and laurestine.

Spicate.—When a number of sessile flowers are produced on a peduncle in the form of a spike, as in lavender, purple lythrum, and common plantain. The axis on which the flowers are seated is called the *rachis;* the spike is generally cylindrical, tapering to a point, or it is angular. In some the flowers are in two rows, one on each side of the rachis, or they are all on one side; the first of these is called a *distichous* and the latter a *secund* spike. In some spikes the flowers are in whorls (*verticillate*), as in many of the Mint family.

Raceme.—When the flowers are arranged on a rachis (as in a spike) but more distant, and each having an evident pedicel, as the hyacinth and foxglove. Some secund spikes and racemes are curved inwards, to which the term *scorpioid* is applied, as in scorpion grass and species of *Tournefortia.*

Corymb.—Is a raceme having the lower pedicels the longest, the upper ones diminishing towards the apex, thus bringing the whole to nearly the same level, each bearing a flower, which flowers, by their contiguity, form a flat or umbel-like head, as in candytuft.

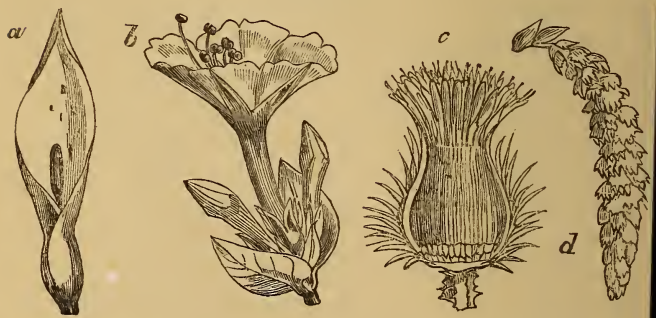
Panicle.—A branched spike or raceme, the branches

generally rising from or near the base of the common axis. They are often contiguous, as in some species of phlox, larkspur, monkshood, and some veronicas; or they are distant, with the lower part often naked, forming loose panicles, as in many grasses.

Thyrse.—A much branched inflorescence, being a compound of the spike, raceme, and panicle, as in the vine, lilac, rhubarb, and many palms.

Ament or Catkin.—A special kind of spike, formed of scales bearing incomplete flowers, chiefly characteristic of the willow, oak, walnut, and allied families (fig. 1, *d*);

Fig. 1.



the male flowers of the fir family is an ament, the female a cone (*see* Fruit).

Clinanthium (bed or receptacle).—A thick spongy or fleshy body of various forms, bearing numerous flowers; in the Contrayerva it is a flat disk with flowers on one side only, in the Osage orange and breadfruit it is globose or oblong, the whole surface being occupied with sessile flowers; in the fig it is a hollow cone, the flowers lining the cavity (*see* Fruit); in the thistle family it is round and flat, convex or columnar, and known as the *receptacle* (fig. 1, *c*).

Scape is a term applied to special flower-stalks of some rootstocks, such as the simple naked peduncle of the primrose and cowslip; it is common to bulb and leaf corms, as also to some Palmids, examples of the first being tulip and hyacinth, and of the latter, cycads and grass trees; it is also applied to branched peduncles, as in Adam's-needle, and aloes.

Culm is a term applied to the flower-stalks of grasses.

The inflorescence is either naked or furnished with small leaf-like appendages called *bracts*, or more or less surrounded or enclosed in leafy cups or sheaths, termed *involucre* and *spathes*.

Bracts are seated immediately below the flower, on or at the base of the pedicel or peduncle; they are often small and scale-like, in some flower spikes they are broad, closely overlapping one another like tiles on a roof, *imbricate*, in the form of a cone, as in many of the Acanthus family.

Involucræ are either small leaflets in whorls seated below each flower, as in the Mallow family, or below the common axis of the pedicels of umbels; in the Virginian spider-wort, and others of the same family, it is in two pieces, like a bivalved shell, enclosing many flowers, and in the Marvel of Peru it is in the form of a leafy cup (fig. 1, *b*); in the Composite family it consists of numerous imbricated scales, forming compact heads of numerous small flowers, called florets; both bracts and involucre are often highly coloured, as in many of the Acanthus and Euphorb families, Bougainvillæa and scarlet Monarda. The difference between bracts and involucre is often not evident; for instance, the male spike of the banana, which consists of closely imbricate bracts, their base nearly surrounding the axis, each being common

to a cluster of sessile flowers, thus partaking of the character of involucre.

Spathe is a kind of involucre, opening on one side in the form of a sheath, generally erect, sometimes like a hood, the flowers being borne on a spike, raceme, or more compound inflorescence, which is called *spadix*, of which the Arum and Palm families are examples (fig. 1, *a*). It is sometimes thin, leafy, and membranous, as in the leek, daffodil, and many Arums; but in some of the latter, Strelitzia, and Palms, it is often thick, firm, and hard. In some it is highly coloured, and in the common trumpet-lily it is nearly pure white, in others it is wide and spreading, and of a brown or even black colour, and many of them very fœtid, while *Caladium odoratum* is the contrary.

The true spathe is found only in the class of plants with parallel veined leaves, some net-veined plants have their flowers in sheathing bracts, similar to a spathe, as in the rhubarb.

I now proceed to speak of the forms and parts of flowers individually.

The study of Morphology, that is, the transformation or change which the organs of a plant undergo, shows that flowers are merely transformed leaves. But much investigation is required before it can be shown that the curious and splendid flowers of Orchids, Victoria lily; or the insignificant ones of Palms, Rushes, and Grasses, are formed of metamorphosed leaves, and although there is much evidence in support of this theory, it is only necessary for our purpose to notice that such views exist. When a plant flowers, it has put on its bridal dress, the costume of which is as varied as the fashions of the different nations of the earth, being either plain or bril-

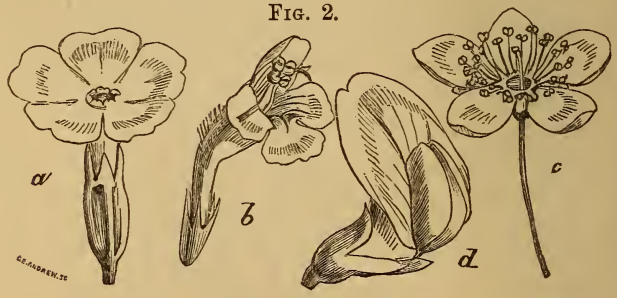
liantly coloured, and from the simplest to the most grotesque in form; or sometimes quite deficient of ornamental appendages. On examining any common regular-formed flowers, such as the primrose, convolvulus, phlox, buttercup, strawberry, cherry, apple, &c., they will be found to consist of five distinct parts, which in the different families of plants present great variation in size, form, and relative position to one another. The first is the the outer covering called *calyx;* the second the interior part, generally white, or of some brilliant colour, called the *corolla,* and which to common observers constitutes the true flower. The third interior are thread-like bodies (often very short) in greater or less number, called *stamens;* fourth, in the centre, round which the stamens are arranged, are one or more pin-like bodies, generally with a pointed, flat, round, simple, divided, or rayed top, which are called the *pistils* or *pistilla.*

Fifth, on the removal of the calyx, corolla, and stamens, the pistil will be seen seated on a round knob, or more or less elevated column called the *ovary* or *germen,* which contains rudimentary seeds and becomes the fruit; it terminates the footstalk of all flowers, which is either a mere point or more or less flat or convex disk called the *thalamus* or bed. In many cases its apex only is seen, its body being seated below the calyx. The difference of form and number of these appendages, and their relative position to each other, furnish the data upon which the classification of flowering plants into families is founded. It is therefore necessary to describe them individually.

Calyx.—As already stated, the calyx is the outer covering of the flower; it varies extremely in size and form, being either small and inconspicuous, or large and

often highly coloured, as in the fuchsia. It is either perfect or imperfect, sometimes entirely wanting, its place being then represented by scales or bracts, as in the walnut and poplar. When perfect, it consists of one, two, or many separate pieces, each piece being called a *sepal;* therefore when of one piece it is *monosepalous,* when of two or more, *polysepalous.* When monosepalous it is in the form of a tube, or inflated like a goblet, or its mouth is wide and spreading like a cup or open dish; or it is even flat like a disk, as in the pretty greenhouse creeper *Rhodochiton.* Its margin or rim is either entire, equally or unequally notched, toothed, or deeply cleft,

Fig. 2.



the divisions being called *lacinæ.* Common examples of these forms are to be seen in the primrose, clove, catch-fly, and potato.

The strawberry, geranium, and ranunculus are examples of polysepalous calyx. The lacinæ and sepals are either equal in form and size, as in the strawberry, or very unequal, as in the pea family.

In a genus of tropical shrubs called *Mussænda,* the calyx is five-parted, four of these parts being very small, like dents, and of a green colour, while the fifth is large, nearly round, one to two inches in diameter, of a pure

white, yellow, or red, which by their position to each other have the appearance of a large open flower. In many plants the calyx generally falls away soon after the opening of the flower; or is more permanent, increasing in size, and becoming inflated, as the winter cherry, or it becomes fleshy like an apple, which is only the tube of the calyx enlarged, and embedding the ovary. In the lily and allied families the calyx is not obviously distinct from the corolla, the flowers consisting of six parts, generally of uniform size and colour; it is however, found that they are in two whorls of three each, the three lower representing the calyx; in some the parts are more or less united, forming a monopetalous flower; the term *perianth* is usually applied to cases of this kind.

In the genus *Eucalyptus* (gum trees) and the yellow-flowered plant known as *Eschscholtzia*, the calyx, instead of opening in the usual way, becomes transversely circumcised, the upper portion falling away in the form of a cap or extinguisher, the margin of the lower part representing a ring. This kind of calyx is called *operculum*.

Corolla.—The corolla is always seated within or on the calyx. It consists of one, two, or many pieces called petals; when in one piece it is *monopetalous*, when of two or more pieces, *polypetalous*. Monopetalous corollas, when spreading and nearly flat, are called salver-shaped, as in the primrose (fig. 2, *a*); funnel-shaped, as in the convolvulus, rhododendron, azalea, and gardenia; *campanulate*, or bell-shaped, as Canterbury bell and gentianella; *ringent* (gaping), as in monkey flower; *labiate*, or lipped, as in sage, thyme, foxglove (fig. 2, *b*); *tubular*, long and of equal width like a tube, as in the trumpet honeysuckle; *urceolate*, swelling out in the middle, and

having a narrow mouth like an urn or vase, as in most of the species of *Andromeda,* and many heaths. In *polypetalous* flowers the petals vary from linear to nearly round; they consist of two parts—viz., the claw or lower part, by which they are attached, and the broad expanded part, called the limb, as for example the pink and wallflower; but in many cases the distinction between the claw and limb is not very evident. The petals vary from few to many, the prevailing numbers are 3, 4, 5, and 6, 5 being the most general (fig. 2, *c*). When the margins of petals overlap each other the flower is called *imbricate,* tiled; when the edges are parallel and touch, even to have the appearance of being united, it is called *valvate,* like valves. The chief distinctions are as follows:—*cruciform,* when it consists of four petals placed in the form of a cross, as in the wallflower, ten-week stock, and all the cabbage family; *rosaceous,* when of five uniform petals, being spread open like a rose; this is common to many flowers, even inconspicuous ones; *papilionaceous,* butterfly-like, in which the petals are of three kinds, the lower edges of the two lowest being loosely united, giving the appearance of a boat and called *carina* or keel; above it on each side are two petals, generally spread sideways or standing forward, which are called *alæ* or wings; above them is the *vexillum* or standard, which has an upright direction and is usually large and round; the pea, laburnum (fig. 2, *d*), furze, and broom are common examples. The corolla varies in size and splendour, from a minute one like that of the chickweed to the magnificent magnolia, cactus, and Victoria lily; these are even far surpassed by the monstrous flower of *Rafflesia Arnoldi* (which see). Their texture varies from a thin membrane, as in the generality

of common flowers, to thick and firm, as in the magnolia; or fleshy, as in stapelia. In odour too they vastly differ, the violet and rose presenting a strong contrast with the *Stapelia* and *Aristolochia*.

Flowers are called *regular*, when all their respective parts are equal in size and form, as in the primrose, apple, phlox, potato, &c.; *irregular*, when the parts of the corolla differ in size and shape, as in the violet, tropæolum, pea, fleur-de-luce, and orchis families. They are termed *single*, or uniform, so long as they retain the special forms, position, and number common to the whole of the plants of the species, wild or cultivated. *Double*, when by cultivation or some hidden cause one or more of the parts change, as when the stamens and pistils become petaloid, which change or metamorphosis gives rise to the beautiful double flowers of our gardens—as the wall-flower, ranunculus, poppy, pæony, pink, carnation, rose, &c. Sometimes regular flowers become irregular; this is known as *pelorism*, of which the common toad-flax is an example; as also the erect flowering varieties of *Gloxinias*.

In many plants the corolla is absent, the flower then being called *apetalous*—that is, without petals. The presence or absence of calyx and corolla affords characters for dividing a great class of plants into three divisions. First, those without calyx or corolla are called *achlamyds*, without a covering, as the birch, willow, and oak families. Second, with a true calyx, *monochlamyds*, one covering; of which the Marvel of Peru, sweet bay, mezereum, nettle, dock, and amaranth are examples. Third, those with calyx and corolla complete, *dichlamyds*, which is common to the majority of flowering plants.

In grasses, and all kinds of corn, the calyx and corolla are replaced by envelopes called *glumes* and *paleæ*, which enclose the stamens and pistils in the form of scales, becoming the chaff of corn.

Stamens.—The stamens consist of two parts—the *filament*, or support, and the round or oblong body borne on its apex, called the *anther*. It must, however, be understood, that in many instances the filament is often very short, or even entirely absent; the anthers are then said to be *sessile*.

The stamens vary from one to many, the number

Fig. 3.

generally corresponding with the number of parts of the calyx and corolla; two to four or five, or their multiples, is the usual number in plants with net-veined leaves, and three or six in plants with parallel-veined leaves. Each stamen is either free, or the filaments are broad and connected at their bases, or for their whole length upwards, forming a tube surrounding the ovary and pistils, as in the mallow, geranium, passion-flower, and pea families (fig. 3, *c*). In the latter, there are in most cases nine connected together, and one loose and free (fig. 3, *d*).

In St. John's wort, and some of the Australian myrtle family, a number of filaments are united together at their base in three or more bundles surrounding the pistil. In the Composite family, the anthers are linear and united by their edges, forming a tube, while their filaments are free (fig. 4, *a*). These four modes of union characterize the sixteenth, seventeenth, eighteenth, and nineteenth classes of Linnæus.* In the twentieth class of Linnæus, which includes the great family of Orchids (fig. 4, *b*), the stamens are borne above the pistil, both of which are of a special nature, as also those of the

FIG. 4.

Swallow-wort family (fig. 4, *c* and *d*). (*See* character of these families.)

When the stamens are numerous in a flower, they generally vary in length; but in the *Labiate* and *Cruciferous* families they are always of a definite length with regard to one another. In the former, there are four—two long and two short (fig. 3, *a*); in the latter, six—four long and two short (fig. 3, *b*). These characterize the fourteenth and fifteenth classes of Linnæus.

Stamens present three modes of attachment:—First,

* See Classification.

below the base of the ovary, as in the poppy, pæony, mallow, pea, and cabbage families; such being called *hypogynous* (fig. 5, *a*). Second, on the interior side of the calyx and corolla, as in the apple, plum, and strawberry families; they are then called *perigynous* (fig. 5, *b*), that is, round the ovary. Third, on the top of the ovary (within the corolla), as in the day lily, fuchsia, evening primrose, campanula, gooseberry, and cactus; they are then called *epigynous* (fig. 5, *c* and *d*), growing upon the ovary. These three terms are also applicable to the calyx and corolla; the first and last denotes the calyx and

Fig. 5.

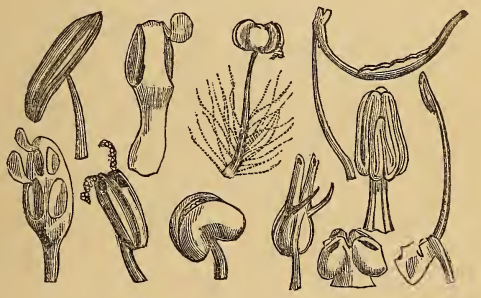
corolla being inferior and superior, or when speaking of the ovary or fruit, the opposite.

In some cases, especially in the plants contained in the fourteenth class of Linnæus, when the corolla is oblique, the stamens are generally on one side, and called *declinate*.

The words *Thalamifloræ*, *Calyciflorœ*, and *Corolliflorœ*, are divisional terms used by some botanists; the first two being equivalent to hypogynous and perigynous, and the third when the corolla is monopetalous, with perigynous stamens and free of the calyx.

Anthers and Pollen.—As already stated, the anthers are borne on the apex of the filaments; they are of different forms, and attached in various ways (fig. 6). In the lily and passion-flower they are linear and loosely attached by their centre, and are easily moved about, being called *versatile*. They are often globose or oblong, and attached to the side of the filament. Each consists of two cells, which open either by a slit, or pores at their apex, as in rhododendron; or by valve-like lids, as the sweet bay. The cells contain a matter like powdery dust, generally of a yellowish colour, called *pollen*, which, on

Fig. 6.



being examined with the microscope, will be seen to consist of definite bodies, varying in size and shape in different plants (fig. 7, *a*), being *globose*, *oblong*, like grains of wheat, or *tri-lobed*. Their surface is either dotted, striated, smooth, rough, or prickly. On the application of moisture, they after a time burst and protrude a thread-like body called the pollen tube (fig. 7, *d*), which is the essence of fertilization. (*See* Fertilization.)

The Pistil.—The pistil or pistils, there being often more than one in a flower, is seated on the ovary, and, when perfect, consists of two parts, the lower part being

called the *style*, and the upper or apex the *stigma*, from which there is a channel of communication through the style to the ovary. Both parts vary extremely in form and organism (fig. 7, *b*). The style varies greatly in length, being in some species of *gardenia* and *cactus* thread-like, from four to six inches long; it is often very short or entirely wanting (the stigma is then sessile). It is either simple, forked, or branched, each terminating in a stigma, which is a simple point, pin or club-like, or rayed as in the Mallow family (fig. 7, *b*). The stigma is often thick and fleshy, or thin, membranous and petal-

Fig. 7.

like, consisting of two or more lobes, as in *mimulus;* or like a cup, hooded cyst, or cavity. Its surface is more or less smooth, viscid, pilose, fringed or feathery as in grasses.

Ovary.—The ovary (fig. 7, *c* and *d*) has already been described as containing the germs of the future seeds, called *ovules.* In size, form, and nature it varies extremely in different plants, and together with the number, position, and mode of attachment of the ovules forms a special branch of study to the scientific botanist. For the use of the amateur it will be sufficient to describe only

the most important points. The ovary consists of either one entire piece like a bladder, or of two, three, four, five, or more pieces united by their edges, the line of union, or seam being called the *suture*, and the pieces *valves*. An ovary so formed is called *valved*, and according to the number of pieces, *bi-valved*, *tri-valved*, &c. The interior consists of one chamber, or it is divided by one or more partitions meeting in the centre (fig. 7, *e*), being what are termed (in the fruit) *dissepiments;* they are either simple, straight, wavy, or branching and uniting in various ways, forming equal or unequal cells called *loculi*. Each cell contains one, two, or more ovules, and whatever may be the character of the ovary or fruit as regards the number of cells, or whether the cells contain one or many ovules (even to several hundreds, as in the poppy), each ovule has a special attachment to some part of the inside of the ovary, the point of attachment being called the *placenta*, which consists of a simple point, or of thickened lines or ridges rising from the internal surface of the ovary or partition, or of an elevated disk or central column (fig. 7, *c*). These points, lines, or columns have a direct connexion with the tube of the pistil, through which by induction the ovules become fertilized (see Fertilization).

The attachment of the ovules to the placenta is more readily seen as the fruit advances to maturity; for example, on opening a young pea-pod the ovules will be seen lying in a row on one side attached to a thickened cord (the *placenta*), which is the continuation of the footstalk terminating in the pointed apex of the pod, originally the base of the pistil.

In general, superior ovaries are sessile, but some are elevated above the thalamus. In the passion-flower and

caper families it is in the form of a slender peduncle, and in the sacred bean it consists of a thick spongy body bearing ovaries on its flat apex (fig. 8, *d*). Such kinds of supports are called *gynophore.*

Besides the above special organs some flowers have supplementary ones that have received the name of *nectaria*, and embrace all irregular anomalous structures, either in the form of an appendage, small knobs, glands, or cavities; as the globular heads seated on the footstalks in Parnassia, or the cavities seen at the base of the corolla of the crown imperial, or the little scale in the inside of base of the petals of pile-wort, also the hooked spur of the petals of columbine, and many other such kinds of structure.

Although many glands and cavities contain honey, others do not, and on considering that a number of flowers bear honey without any evident nectary, therefore many nectaries (so called) must be viewed as various modifications of parts of the flower only.

In many plants flowers are often imperfect, that is, wanting one or more of the parts; in some the stamens, and in others pistils are absent, in others the corolla, and often also the calyx. But it must be understood that stamens and pistils, together or separate, constitute a flower, without either calyx or corolla. A flower with stamens and pistils is called *bi-sexual* or hermaphrodite; *unisexual* when either the stamens (male organs) or pistil (female) are alone present; both may be in different flowers on the same plant, or in flowers on separate plants of the same species. When separate male and female flowers are on the same plant they constitute the twenty-first class of Linnæus, called *Monœcia*, and when on separate plants, the twenty-second class, *Diœcia.* This

is, however, not a constant character, diœcious plants often proving to be monœcious.

The above are the principal forms which, in accordance with our ideas, represent what are called types of nature's rule of construction, and any deviation from the above may be looked on by some as freaks of nature; but this is not admissible, for the most odd and grotesque forms in orchids, aristolochias, and others, are as typical of nature's rule as the most regular flowers, all those forms which appear as irregularities being brought about by a mere difference in size and form, or by a suppression of one or more parts. This may be seen by comparing the flowers of the pea, bean, or scarlet-runner, with those of the cherry, plum, peach, or almond; the same number of parts will be found in each, and having the same position with regard to one another; but in the pea the petals are of various forms, and so placed as to give the appearance of being irregular as compared with the cherry, or as an orchid is to a tulip or lily.

Fertilization, and its Results.

Whatever may be the form or number of parts in a flower, it must be admitted that they are intended by nature as aids in a process for accomplishing the final destiny or purpose of a flower, which is to generate, organize, and perfect certain bodies containing the embryo of a future plant, called the seed. This object is attained by a process common to all flowers, viz. by one or more grains of pollen coming in contact with the stigma, which takes place either by the contiguity of the parts, by gravity, by motion of the air, or by what may be called mechanical aid, the agents in the latter case being chiefly insects; or by the elastic spring of the stamens, as in the

barberry, *Kalmia*, and *Stylidium;* or by forcible discharge from the anther, as readily seen in pellitory and nettle, the pollen looking like puffs of smoke, giving the idea of a miniature cannonade.

Flowers have been compared to public-house signs, inviting guests to a repast, the guests being the insects, and the viands pollen and honey. By the movement of the insect in the flower the pollen becomes dislodged from the anther and dispersed; some of it comes in contact with the stigma, or by adhering to the insect, is carried by it to other flowers. In some cases it is necessary for the insect to be caught in the flower, which in *Aristolochia* is accomplished by the inside of the tube being beset with stiff hairs pointing downwards, like a mousetrap. This is more remarkable in the pretty orchid genus *Pterostylis*, the flower being in the form of a hood or cowl, open in front, from which hangs the part called the *labellum*, in the form of a strap or tongue; on this being touched by an insect entering, it immediately turns up like a flap and imprisons the intruder. In some of the Pea and Trumpet flower families, Snapdragon, Monkey flower, and others, bees find it difficult to enter, but have sufficient instinct to know that the honey lies at the bottom of the flower, and in order to obtain it they cut a hole in the side, thus leaving the pollen untouched. The viands, however, are not always pollen and honey; in the remarkable flowers of *Rafflesia*, *Stapelia*, and *Aristolochia*, the bluebottle and other flies are attracted by their carrion-like odour, and even deposit their eggs in them. In many flowers, such as orchids and asclepiads, insects are indispensable for bringing the pollen in contact with the stigma.

After having received the pollen, the stigma is said

to be *fertilized*, soon after which the calyx, corolla, and stamens generally wither and fall away. The ovary at this time contains one or more soft granular bodies, called *ovules*, being embryo seeds; shortly after this the ovary begins to enlarge, increasing in size until it arrives at maturity, when the plant is said to be in seed, or more properly in fruit, which is very various in form and structure.

In order to insure fertilization, nature is profuse in the supply of pollen, the quantity used being infinitely small to that wasted. When corn and grass are in flower it floats in the air, and is supposed to be the cause of some diseases, especially "hay fever." In the Fir family it is produced in abundance, and in fir forest countries is carried to a great distance, even to hundreds of miles, and on falling to the ground forms a yellow crust like sulphur, which has given rise to the idea that it had rained brimstone; such may be seen near fir trees in this country.

From what has been stated, it may be presumed that the proximity of the stamens and pistil or pistils in hermaphrodite flowers is for the purpose of insuring fertilization. Mr. Darwin has, however, shown that such is not the case in all flowers; experiments with the *Primula, Lythrum, Linum,* and passion-flower prove that the pollen is inert on the pistil of its own flower, but effective in fertilizing the pistil of other flowers. In many plants, such as the grass of Parnassus, the stamens and pistils are not perfect at the same time, the pollen being shed long before the pistil is perfect; in others, such as banana, it is the contrary, the pistiliferous flowers being early developed, and the ovary swelling long before the male flowers are free of their enclosing

envelope. Similar instances in other plants have been recorded, and as the subject is of horticultural interest, it will be curious if it should be discovered that our good or indifferent crops of fruit are partly due to conditions favourable or unfavourable to the interchange of pollen in flowers.

In whatever way fertilization may be performed, it is generally understood that no perfect seed can be produced without the action of pollen, of which *Aucuba japonica* affords a recent and striking example. This beautiful shrub has been grown in this country for above eighty years, and all being female plants, no fruit ever was produced until 1863, when the male plant was introduced, and plants are now to be seen bearing abundance of beautiful red berries. But there is no rule without an exception, as several plants are recorded as producing perfect seeds without the intervention of pollen. The most remarkable instance of this is a holly-like leaved plant, native of Queensland, plants of which were introduced at Kew about forty years ago. They proved to be (three) female plants, belonging to the spurge family, and produced perfect seeds, from which young plants were raised similar to their parent. In 1838 I named this plant *Cœlebogyne ilicifolia*, and a description with a figure having been published in the Transactions of the Linnean Society, it became an object of interest and discussion with the botanists of Europe, much having been written on the subject; up to the present time all the plants in Europe continue to maintain their unisexual character, and no explanation has yet appeared to account for this deviation from the law of sexuality. Plants of it have recently been discovered in Queensland bearing abundance of male flowers, but this fact in no

way helps to explain the fertility of the female plants in Europe during the last forty years.

This kind of propagation is called *Parthenogenesis.*

Fruit. (L. *fructus*, G. *carpos.*)

"Every tree in the which is the fruit of a tree yielding seed, unto you it shall be for meat." The practical application of this sentence implies that when fruit is the subject of common conversation, apples, pears, plums, cherries, peaches, &c. come before the mind; but in botany the word fruit has a very wide application, embracing all conditions of the part of a plant containing seeds, from the luscious peach to the dry spiny husks of the thorn-apple, and the chaff-like produce of the lettuce and carrot. The position and arrangement of the fruit is in accordance with the inflorescence, but although nature is generally profuse in flowers, perfect fruit is comparatively rare; this is due to several causes—imperfect fertilization, the effect of climate, ravages of insects, and the like.

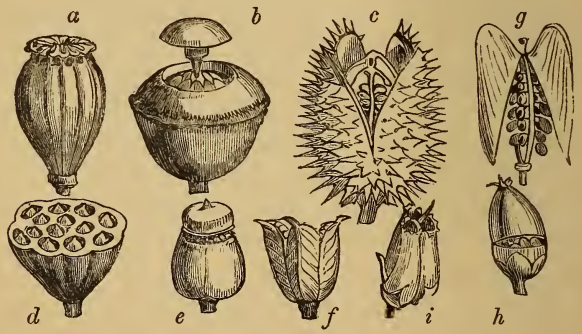
Fruits present many varieties of form, being *globose, cylindrical, angular, flat, spiral,* &c.; and in consistency are *solid, hard, fleshy;* or *dry, husky, thin, thick,* or *fibrous.* In size they vary from less than a currant to a large pumpkin, 2 to 3 feet in diameter; and from the caraway to the sashline-like snake gourd, 5 to 6 feet in length. Fruits are also *smooth* or *rough,* as in goose-grass; *warty,* as horse-chestnut; or *prickly,* as stramonium. When ripe they are of a pale brown, yellow, or red colour, some even black.

The following are some of the principal names applied to fruits:—

Poma, succulent fruit, as apple, pear, and orange.

Drupe, pulpy stone fruit, as plum, date, cherry, and peach. *Pepo*, a term applied to cucumber, melon, gourd, and vegetable-marrow. *Bacca*, a berry, as gooseberry, currant, and grape. *Legume*, a two-valved pod, as pea and scarlet-runner. *Follicle*, a pod-like fruit, opening on one side, as pæony, aconite, and the whole of the Proteæ family (fig. 8, *f*). *Siliqua* and *Silicula*, a seed-pod of the cabbage tribe, cress, and shepherd's purse (fig. 8, *g*). *Capsule*, a dry fruit consisting of three or more parts called valves, as horse-chestnut and stramonium (fig. 8, *c*);

Fig. 8.



sometimes opening by pores on the apex, as in the poppy (fig. 8, *a*), or by an *operculum* or lid, as in the monkey-pot (*Lecythis*, fig. 8, *b*), and henbane (fig. 8, *e*). *Dry drupe*, as the cocoa-nut. *Glans*, a one or several seeded fruit contained in a cup or involucrum, as in oak, hazel-nut, beech, and sweet-chestnut. *Samara*, a one-seeded fruit, either seated in the centre of a thin membrane, or at one end, called *winged*, as in elm, ash, and maple. *Achenium*, a term applied to the fruit of the whole of the Composite and Umbel family, the fruits of which are generally called seeds; they however consist

of an outer coat, within which is the true seed. *Strobilus* or *cone*, an imbricated scaly inflorescence, composed of hard bracts, seated round a central woody axis, bearing two or more naked seeds at their base, as in cedar of Lebanon, Scotch and spruce fir. Cone is also applied to the fruit of Banksia, which is formed of a spike of woody follicles that becomes solid and hardened. *Galbulus*, a fruit composed of thick fleshy scales, which become hardened and compact into one uniform, globose, smooth, plane or horned mass, as in juniper, cypress, and arbor-vitæ.

An ovary with its pistil is termed a *carpel;* when one or more in a flower and free, they are called *apocarpous* (free), as in the ranunculus, larkspur, and pæony; when united together, *syncarpous*, as in custard-apple, magnolia, strawberry, and raspberry; in the mulberry, pine-apple, and screw-pine, a number of individual fruits (separate flowers) being united they are called compound.

The fig is also a remarkable instance of a compound fruit; it consists of a hollow conical receptacle attached by its narrowest end, having a small opening at its broad apex, its interior being lined with numerous apetalous florets, containing stamens and pistils which ultimately produce small grains, the true fruit of the fig.

Fruits are either one or many celled; when the seeds are all contained in a single compartment, as in the Pea family, it is called *unilocular* (one-celled). On cutting an apple across, the seeds will be seen lying in five cells radiating from a centre to which the seeds are attached; it is hence called *multilocular* (many-celled). The orange is also divided in the same manner into cells filled with pulp, amongst which the seeds lie embedded.

Pericarp is a general term for the outer covering, rind,

or skin of all fruits, and *dehiscence* for the manner in which fruits burst or open and discharge their seeds. Many fruits are *indehiscent* (not opening), such as plum and gooseberry, which fall to the ground and rot.

Fructification is a term applied to the reproductive parts of the flower, but more especially to plants in fruit.

Seeds. (L. *semen*, G. *sperma*.)

On opening a pea-pod the seeds will be seen attached to the pod by a short cord rising from the eye of the pea, called the *funiculus*, or umbilical cord, which when ripe separates, and a mark or scar is seen, called the *hilum* or eye of the pea, as the black scar in the bean and white scar in the scarlet-runner. Seeds vary as much in size and form as fruits, the poppy and horse-chestnut being familiar examples. Some tropical trees, such as *Carapa* and *Mora*, have seeds as large as a good sized apple, but are far exceeded by the double cocoa-nut, which often weighs from 30 to 40 lbs. The smooth bright seeds of Prince's feather and flax present a strong contrast to the rough and unshapely ones of *Martynia proboscidea*, which is a black hard body with two long horn-like hooks, having more the appearance of a stag-beetle than the seed of a plant.

Hitherto I have spoken of the exterior appearance, called the coat or covering; it is now necessary to notice the interior. The substance that forms the bulk of a seed, with the position and direction of the embryo, and its manner of germination, presents many curious phenomena, which are too numerous to be mentioned. It is sufficient to state that seeds in general are furnished with two skins or coats, called the integument, for protecting the ovule and embryo, being analogous to the shell and

inner skin of an egg; but in the fir and cycad families the ovule is destitute of a seed coat, hence these plants are called *gymnosperms*, that is, naked seeds. The ovule contains the embryo only, or it consists of soft or hard matter called albumen, with the embryo embedded in it. This matter is homogeneous, and abounds in wheat and barley, becoming the farinaceous part, as flour and all corn meals; it is also plentiful in palms, as for example the white of the cocoa-nut. Its presence or absence characterizes many natural families. Seeds containing it are called *albuminous*, and those without it *exalbuminous;* the pea and bean are examples of the latter, the part eaten being the seed leaves of the embryo.

Germination of Seed and Young Plant.—I have now described the principal forms of the various parts of a plant, from the root upwards to the perfect seed, within which by the power of nature's act, an *embryo* or *germ*, endowed with the vital principle of vegetable life, has been generated, so that on the seed falling to the earth and becoming influenced by heat and moisture, the vital power of the embryo is excited, and immediately commences the growth of a plant like unto its parent.

In order to observe the process of germination, place a few seeds of corn, onion, radish, mustard, pea, bean, &c., in a shallow vessel on wet brown paper, or other substance retentive of moisture, covering them with the same kind of material, and placing them in a moderately warm place in the dark. After a short time a change will take place, being first apparent by the swelling of the seeds. In the pea and bean the coat bursts, and two lobes are seen to open, and at their base or point of union is seated a small body called the *plumule* (the embryo bud of the future plant), which lengthens upwards and forms the stem;

a root called the *radicle* is also produced downwards, the two lobes being *cotyledons*.

In palms, cycads, grasses, lilies, &c., a white point or teat is first seen to protrude, which, in ordinary seeds, is short, but in palms lengthens from one to several inches, or as in the double cocoa-nut, even to two feet in length; be this short or long, it is called the *cotyledon*, and contains the *plumule*. In time its apex opens by a pore, slit, or cleft, from which issues a green leaf, as also a little rootlet (*radicle*), forming the basis of the future plant, other leaves being successively produced. The former of these modes of germination is called *dicotyledonous* (fig. 13, *a*), that is, having two seed lobes; the latter *monocotyledonous* (fig. 11, *a*), with one seed lobe.

The cotyledons vary greatly in size, form, and texture, in different plants; in the radish and cucumber they are thin and green, being more leaf-like than in the bean. The common mustard and cress afford a good example, the part eaten as salad being the cotyledons, between which the plumule is seen to arise to form the plant. In the pea, bean, and horse-chestnut, they are thick and fleshy. In general the cotyledons soon give up their functions, and wither; but in the genus *Streptocarpus*, a South African plant, with flowers like a *Gloxinia*, and the remarkable *Welwitschia mirabilis*, they increase in size, in the former becoming quite a natural-looking leaf, six or more inches in length, in the latter, more remarkable, attaining the length of four or more feet; in both cases they perform the functions of leaves.

In some *dicotyledonous* plants the seed lobes are so closely united (*connate*) or consolidated, as in the Indian cress, that they appear as one. In thick-skinned seeds, such as acorn, sweet chestnut, and many of the Pea

family, the coat of the seed remains entire, thus preventing the expansion of the cotyledons; in such cases the plumule is protruded in a manner analogous to monocotyledons, the acorn remaining entire long after the young plant has become established.

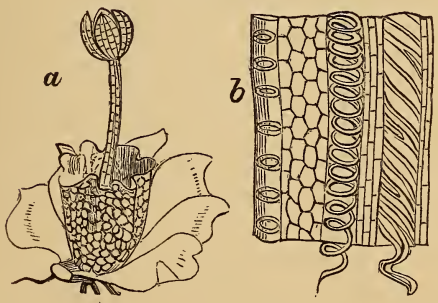
The embryo of all flowering plants partakes of one of the above characters, and hence come two grand divisions of the vegetable kingdom—*Monocotyledons* and *Dicotyledons*. Plants produced from these two kinds of seeds are readily known by the structure of their stems, and veins of their leaves, which will now be described.

III. ANATOMICAL STRUCTURE AND VITALITY.

Construction.

When examined by the aid of the microscope, the sub-

Fig. 9.



stance of which plants are composed is found to consist of what is called *cellular* and *vascular tissue*. The former is a conglomeration of thin membranous vesicles, united to one another, forming cells like those seen in wheaten bread (fig. 9, *a*), endowed with the power of producing their like, and by that means increasing the bulk of the plant. The normal form may be con-

sidered spherical, but by equal pressure on one another the section represents a hexagon, which however assumes various forms in different plants. These are the elementary organs or simplest condition of vegetable structure, and known as *cellular tissue.* *Vascular tissue* consists of membranous tubes of various kinds, lying embedded in a vertical direction in the cellular tissue. They either taper to each end, or terminate abruptly; some enclosing a closely coiled spiral thread, called spiral vessels (fig. 9, *b*), which may readily be seen on gently tearing asunder the stalk of many plants, such as rhubarb, the young shoots of elder, footstalks of strawberry leaves, and many bulbs. *Ducts* are other kinds of tubes, transversely marked with rings or bars, but do not uncoil. Woody tissue, or fibre, consists of slender tubes in bundles, narrowing at both ends. In the Fir family it is perforated with pores called *glandular tissue.* Many other curious forms of vessels are found in plants, all affording great scope for microscopic investigation, of the nature of which, and the part they act in the life of a plant, there are various opinions. Knowing that such is the plan of construction, the microscope is not at first necessary to the amateur student for his practical study of outer forms.

From what has been stated above, it will be seen that the structure of plants consists of simple cells only, or of cells and tubular vessels combined; the first comprehends *cellular* plants; or *Cryptogams* (flowerless), consisting of the whole of the plants in the twenty-fourth class of Linnæus — viz., mosses, ferns, lichens, algæ, and fungi. These are the lowest types of vegetable life, having no visible stamens, pistil, or true seed, their reproduction being by what is called spores.

The second are called *vascular* plants (from vas, a tube), or *Phænogams*, and include all flowering plants, which hold the highest rank in the vegetable kingdom, having flowers with stamens, pistil, and perfect seed.

According to Dr. Lindley's "Vegetable Kingdom," published in 1853, above 92,000 species of plants were said to be known to botanists; but by new discoveries since then the number may now be calculated at not less than 100,000, of which 15,000 may be set down as cellular or flowerless, and 85,000 as vascular or flowering plants. It is the latter we have now to consider, and the mode of classifying them into families; they present important distinctive characters, dividing them into two great divisions, which are readily distinguishable from each other in three ways:—First, by the seed; secondly, by the mode of thickening of the stem; thirdly, by the leaves.

The mode of formation and increase in the size of the stem takes place in two distinct ways:—First, by a successive formation of cellular, vascular, and woody tissue, round a central axis called the *pith*, and is of two kinds —the inner being the solid or woody part of the tree, the outer, less solid, called the *bark*. Between the bark and the wood successive annual layers of new structure are deposited in the form of concentric, solid, erect cones, each cone answering to a year's growth, and are well marked in transverse and vertical sections of many trees, especially of the Fir family. From the centre or pith proceed erect, thin plates in the form of rays, which unite with the annular circles of increase, proceeding on to the bark, and are called *medullary rays*. In a transverse section, they appear like spokes passing through a

number of concentric wheels. This mode of structure is termed *exogenous* (growing outward), and is the result of all seeds having two seed-leaves; it is further well marked by the veins of the leaves being connected together in irregular meshes like network, as may be seen in all trees and shrubs, as well as most herbaceous plants in the open air in this country (fig. 13, *a*, *b*, *c*), the exceptions being the Fir and Yew families, which have free veins.

Although many plants with reticulated leaves have no apparent stem, the bud or crown (gemmæ-corm) from which the leaves spring, is formed on the principle of outward extension, such being the case with many herbs.

The second mode of stem-formation is the reverse of that above described, the increase taking place by successive development of leaves on the apex of an axis which increases in length. In this case, there is no distinction between bark and wood, consequently no concentric rings, a vertical section showing the increase of new matter to be from the base of the leaves inwards, the whole being homogeneous. The consequence is, that most tree stems of this division maintain a cylindrical form throughout, increasing but little in diameter, that which takes place being due to the outward pressure of additional new matter forming in the interior. In some aloes and scandent palms no increase takes place, even although (as in the latter) growing to one hundred or more feet in length. This mode of structure is termed *endogenous* (growing within), and is the result of all seeds having one seed-leaf; the structure of the true leaves is also quite distinct from that of the preceding in the veins not being reticulated, but rising from the base of the leaf, running parallel towards

the apex, as may readily be seen in the Lily, Iris, and Grass families* (fig. 11, *a*, *b*, *c*, *d*); or they diverge from each other or from a midrib, as in palms, banana, cycad, screw pine, travellers' tree, strelitzia, dragons-blood tree, aloes, yuccas, Australian grass trees, and several arborescent species of the pineapple, all having firm tree-like stems.

Besides this characteristic tree structure of endogens, a considerable number of plants of the same division are stemless, their leaves being developed from a bud or crown, which never rises more than a few inches, or scarce a foot above the surface of the ground. This kind of crown or stem varies much in its nature, in many grasses being quite undefined or rudimentary only.

In the bulbous section of the Lily family, it consists of a small thin disc which is the base of the bulb, and produces roots from its under side, the body of the bulb being formed of the broad bases (*petioles*) of the leaves which overlap each other, forming what is called a *tunicate*, or coated bulb, through the centre of which the flower stem rises; the onion and hyacinth are good examples.

From the onion we pass to the leek, the bases of the leaves of which being long, overlap by their lengthened edges, and thus form an apparent stem. This mode of structure is also characteristic of the Banana (*Musa*); and although *M. Ensete* has a stem seven to eight feet in girth, and as much in height, it cannot be viewed otherwise than a gigantic leek (*Phyllacorm*).

From what has been stated regarding the structure of exogens and endogens, it may be ascertained by examin-

* The Sarsaparilla, Yam, and Arum Families are exceptions.

ing the leaves of any flowering plant to which of the two divisions it belongs. But in all systems of plant classification there are many exceptions to the general rule; in the present case the Yam and Sarsaparilla families, hold an intermediate position between exogens and endogens, being bramble-like, leafy shrubs, with reticulated veins, but connected with endogens by having only one cotyledon.

Sap and Secretions of Plants.—All parts of a plant contain a fluid called sap, which, like the circulation of blood in animal life, maintains the vital action of vegetable life; its colour and nature differ considerably in various plants. In the birch, maple, and vine it is clear and limpid; in poppy, euphorbia, India-rubber, and cow trees it is white, like milk; in celandine and gamboge tree, yellow; in the blood-tree of Norfolk Island, red; in aloes and terebinths, green, and becoming black or purple when exposed to the air. Its constituents furnish products of great importance, as sugar, opium, India-rubber, gutta-percha, turpentine, gums, &c., which are obtained either by natural exudation, pressure, distillation, or by incisions. In the latter case the sap runs out, and may be considered analogous to bleeding, and although this process is periodically repeated in many trees, yet they do not appear to suffer from the loss, being again replenished.

Much has been written on the flow of the sap, and curious phenomena have been observed; but here it must suffice to explain only its presumed mode of action. Take for example all trees that shed their leaves in autumn, as the plane, elm, lime, &c.; in winter they may be compared to dormant animals, which on the increasing warmth of spring start into active life. The sun, by

heating the stem and branches expands the sap, the buds swell and the leaves unfold, the roots at the same time perform their duty by producing young *spongioles* that absorb fluid which by the vital action of the plant is carried up through the cellular and vascular body of the tree, enters the leaves (*plant lungs*), and through the stomata comes in contact with and absorbs the constituents of the atmosphere, forming fibre-sap. It is then carried downwards through the vessels of the inner bark, in its course depositing a soft matter called *cambium* between the bark and wood of the tree which solidifies and becomes new wood, thus marking the yearly growth of exogenous trees. The bark also assimilates its constituent elements, according to the nature of the plant. In many plants, such as the family to which the Marvel of Peru and evening primrose belong, the roots of orchids, succulent mesembryanthemums, and stalks of rhubarb, bundles of needle-like bodies are dispersed throughout the cellular structure called *raphides;* in some species of cactus they are extremely abundant, and in form like grains of sand, which are insoluble in water. They consist chiefly of phosphate of lime, but their use in the life of the plant is not well ascertained. That the sap has a general periodic ascent and descent is manifest, but the microscope shows that a local circulation goes on independent of the movement of the sap upwards and downwards. One kind especially observed in milky plants, is in vessels differing from the usual tubular ones in being branched and anastomosing to each other; they are called *laticiferous vessels*, and the milky granules seen circulating, *latex*. This being difficult to observe, it is not known if it is common to plants in general, but by the aid of a powerful microscope it may be seen in the

stipules of India-rubber and other fig trees. Sap circulation is however readily observed in the jointed stems of limeworts (*chara*), the jointed hairs of the stamens of Virginian spiderwort, the spongial roots of frog-bit, and in the leaves of the *Valisneria spiralis*, *Potamogeton*, and other water plants. In the first three each joint has its own circulation, which is easily seen by loose globules of *chlorophyll* being moved by the current, thus forming an interesting spectacle. Although the portion examined is removed from the living plant, the circulation nevertheless continues; and if a small branch of chara is placed under favourable circumstances (in a vial, for instance) new joints will be seen to form, and it becomes a plant. It may therefore be supposed that a plant consists of a multitude of independent organisms, which as a whole unite and contribute to its welfare; but each on being separated is endowed with the vital power of becoming a plant, as, for instance, a twig, a small bit of wood with its bark, a bud, a leaf, portion of a leaf or root, are well known to gardeners as the means for propagating plants. Thus plants have the advantage over animals, and although they have not the power of moving from place to place, yet on considering what has been stated of them in the preceding pages as regards their growth, organs, and functions, their analogy to animals is evident. From many circumstances they are not devoid of knowing what is necessary for their good; they fatten when well fed, the roots of trees find their way to water and new soil, the aerial roots of orchids and aroids direct their course to the nearest surface; and it has been observed in hothouses, when hung near a moist surface, they take a horizontal direction, even forming a right angle. Twining plants or tendrils also direct their course

towards the nearest prop or twig. In some cases they are even furnished with mechanical means to obtain food, for besides the curious insect traps and flowers described at page 52, similar ones are provided in the leaves of other plants, but in this case the entrapped insects appear to be designed for the nourishment of the plant; the most special instances are the Pitcher-leaf family and Venus fly-traps, which see.

Motion of Plants.—Many plants are sensible of light and darkness; various flowers, such as the red pimpernel and daisy shutting up in the afternoon, and the evening primrose opening in the evening. Leaves also collapse and droop in the evening, as in the Clover and Pea family, being called the sleep of plants. This is not, however, in all cases consequent on darkness; motion is sufficient to put to sleep the Humble and Sensitive plants, the least touch of the finger causing them to collapse and droop, thus seeming to shrink from danger, expanding again when it is past. This curious phenomenon suggests that plants have a nervous system, being of a highly sensitive nature. In the Humble plant, the least harsh movement or injury to a leaflet or any part is sympathetically transmitted throughout its whole system. Other plants with jointed leaves show their sensibility, and much has been written on the subject, but it is too extensive to discuss here. These movements may be considered consequent on mechanical force and darkness, differing from the voluntary motion of the moving plant *Hedysarum gyrans*, which will be noticed under its family.

Struggle for Life.—Many plants are capable of retaining life for a considerable period, even after being deprived of roots and leaves, which under favourable condi-

tions are again reproduced, especially in succulent plants and cycas. A remarkable instance is known of long quiescence in a large *Echinocactus*, which by accident lost its centre growth, and after nineteen years, without apparent change, put forth young plants round the injured centre; also a plant of *Geranium Burmanni*, after remaining four years almost in a dry state, again put forth leaves; and specimens of *Lewesia rediviva*, after being two years in the herbarium, have been planted and have produced flowers.

Although many plants are dependent on others for their habitation, they nevertheless pay no respect to one another; the plebeian groundsel and humble daisy being in themselves as consequential in the position nature has assigned them as the princely palm and mighty gum tree. As with man and animals, they war each against their neighbour; the strong takes possession of the domain of the weak, or the weak by degrees overcomes the strong; the slow but sure ivy weaving the winding-sheet of the mighty oak; while the more humble but insidious white clover, knot and couch grass, dandelion, and other European weed plants, displace others which seem more powerful than themselves, as now witnessed in New Zealand, South Africa, and New South Wales.

Nature has furnished plants with the means of increasing and multiplying by producing superabundance of seed, which, falling on "good ground," and being left unmolested, produces its hundred-fold. This combined with the tenacity of life possessed by many plants assists in maintaining their position on the earth, so that if left unmolested they assiduously perform the duties assigned to them according to nature, living their appointed time, some only for a few hours (as in many cryptogams), and others hun-

dreds, and even thousands of years, as in the case of the great dragon tree of Oratava, which has lately paid the debt of nature common to animal and plant life. After having withstood the vicissitudes of five thousand years, it was blown down by a storm in September, 1867. Man and animals have the power and instinct to fly from threatened danger, but plants cannot help themselves. Therefore, from their aggression upon each other, the limited area occupied by some species, the prey they are to animals, to the hand of man, forest fires, the elements of the atmosphere and natural convulsions of the earth, many species become extinct, of which known instances have occurred within the last hundred years.

IV. CLASSIFICATION.

Every plant that differs from another, "whose seed is in itself after his kind," is called a species, being an organized structure endowed with an essence or quality peculiar to itself, and possessing the power of multiplying and transmitting its type and qualities without change, from generation to generation. That such is, and has been, through all historic periods the law by which nature perpetuates the different forms of plants upon the earth under ordinary life, is evident from the remains of plants of past ages agreeing with the present race. For instance, our cultivated corn and fodder plants are the same as those cultivated in the time of the Pharaohs. The remains of flax and hemp fibre, wheat, barley, and apples which have recently been discovered in the deposits of the lake cities of Switzerland, point to the same conclusion; while the flint implements found with them seem to give them a date anterior to Egyptian record.

It is, however, known that on plants of near relationship coming into contiguity, they, like the different races of mankind, commingle and produce intermediate forms, which in many cases assume permanency. If their history were unknown they might be viewed as original species, but to all such forms the term *hybrid** is applied.

Many plants presumed to be representatives of one species often present different appearances, such as some being tall, others dwarfish, or with variously formed leaves, as broad, narrow, smooth, hairy, variegated, &c. Such differences, called varieties, are mainly due to the situation and nature of the climate and soil in which they grow, but in the course of ages become inherent in their constitution. Thus the towering tree of the forest may be seen on the rocky cliff as a dwarf shrub, being in that form as much at home there as its congener in the richest forest land. The birch, oak, fir, &c., are examples in this country. In New Zealand and Terra-del-fuego, the lofty trees of the plains are represented in elevated regions in the form of low bushy shrubs. But those species that have long been under the fostering care of man, have by art and cultivation entirely changed their original nature, and by such means our best wheat, fruits, vegetables, and showy flowers have been obtained.

In many garden plants the varieties are so numerous that the original parent cannot be traced. In other cases, parts of the same plants are so different from each other, that, when separated unknown to the botanist, they have been described as distinct species. This, with the differences brought about by climate, and the in-

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* For particulars on this point, see Darwin's work on "Animals and Plants under Domestication."

crease of hybrids, has led to a great number of plants being described in books as distinct species which, in reality, are not so. Without practical observation, therefore, it is impossible, in many cases, to arrive at any satisfactory conclusion from herbarium specimens alone, as to whether they are distinct species or varieties. The practical cultivator often differs from the scientific botanist, as in living specimens he sees characters, that are indistinct or entirely disappear in the herbarium; these differences being permanent, and becoming familiar to the eye, he feels himself justified in considering the plants distinct species. On taking a general view of what is supposed to characterize species, it may be said to be beyond human power to ascertain whether the serial gradations of form are genuine descendants of original creation, or only deviations from one original, brought about during the lapse of ages by the different climatic and local influences.

Whatever may be the number of species in a genus, each is designated by a special name, called the trivial name, as explained at page 8, and which is derived from various sources, the greater number being either a Greek or Latin word, denoting the form, colour, or property of some part, or organ, or special quality of the plant, such as *angustifolia* and *latifolia*, for broad and narrow leaf; *pauciflora* and *multiflora*, for fewand manyflowered; *edule* and *toxicaria*, for edible and poisonous, &c. Their native country and place of growth also give names to many, as *Trollius europæus*, *T. caucasicus*, *T. americanus*, and *T. asiaticus;* the words *montana*, *pratensis*, *aquaticus*, &c., denoting whether growing in mountain, meadow, or water. Many bear the names of persons, the termination distinguishing the reason; thus, Cun-

ninghami after the discoverer; Cunninghamii after the first describer; Lambertiana in honour of. When named in honour of a lady, the termination is *æ*, as Walkeræ. Many are also derived from native vernacular names of unknown meaning.

When the flower and fruit of two or more naturally allied species agree in number and position of the different parts, they are said to belong to the same genus, to which a special name is given: thus, the apple, pear, and quince are distinct species of the genus called *Pyrus;* cherry, plum, and apricot, of *Prunus;* gooseberry, red and black currant, of *Ribes;* onion, leek, and garlic, of *Allium;* orange, white, and tiger lily, of *Lilium. Malus* being the specific name of the apple, it is therefore called *Pyrus Malus;* pear, *Pyrus communis;* plum, *Prunus domestica;* black currant, *Ribes nigrum;* and the white lily, *Lilium candidum*, &c.

These are sufficient examples to show the use of generic and specific names, as invented by Linnæus.

Of generic names, the greater number are a compound of two Greek words, such as *Chrysanthemum—chrysos*, gold; *anthemon*, a flower—golden flower. Others are derived from the names of persons, with the addition of a Latin termination, as *Banksia*, in honour of Sir Joseph Banks. The remainder are from various sources, as local aboriginal names and Heathen mythology; many of doubtful and unknown origin and unmeaning application have been given by the most learned botanists, which in course of time become familiar, the names being pronounced without any idea of their derivation or meaning.

The number of species in each genus varies greatly. A genus in fact, has no definite limit in nature, and

botanists are as much at variance respecting the character that should constitute a genus, as they are with regard to distinction of species. Some multiply genera and species—the former by excessive subdivision; the latter by raising every distinct variety to the rank of a species. Others reduce the number by including more species in a genus, and regarding the less important varieties as belonging to the same species. This difference is a source of great perplexity to beginners. The latter plan, as adopted by Mr. Bentham in his excellent "Handbook of the British Flora," is much to be preferred for its greater simplicity.

The botanist who describes and names plants is called the *authority* for the name; and it is a rule to affix after the botanical name the abbreviated name of the author. Thus, *Solanum tuberosum*, Linn.; *Araucaria excelsa*, Ait.; *Fuchsia gracilis*, Lindl.; *Hoya carnosa*, R. Br.: these names being given by Linnæus, Aiton, Lindley, and Robert Brown. This is necessary on account of the various names, often very numerous, which have been given to the same plant by different botanists, to unravel which forms a great part of the study of scientific botany. In the following pages authorities are dispensed with, as without a general index for the names of botanists, the abbreviations only serve to perplex the amateur student.

It has been shown that one or more species constitute a genus; the next point is to classify the genera into natural alliances, tribes, and families, by associating together genera that agree in certain particulars, as general habit, mode of growth, structure, and qualities, the name of the leading or typical genus being generally selected as the name of the family. Thus the one to which Ranun-

culus belongs is called *Ranunculaceæ.* In general, most names of families terminate in *aceæ;* but those derived from some special character of the whole family terminate in *æ,* as *Cruciferæ, Leguminoseæ,* &c.

To assist in popularizing the natural system, Dr. Lindley has in his "Vegetable Kingdom" given English names to the families, and in doing so has, as far as possible, adopted the original popular names by which the leading species of families are known. Many British plants are known by the familiar names of *Worts,* which is generally considered to imply soft weedy herbs, as rag-wort, mug-wort, soap-wort, &c. Several of these words have been adopted as the English names to the families they belong to. Dr. Lindley however, does not restrict this term to weedy plants, as he applies it freely to trees and shrubs, such as elm-worts, the Elm tree family; birch-worts, the Birch tree family; apple-worts, the Apple tree family: also to exotics, as citron-worts, the Orange tree family; sandal-worts, the Sandal wood family; Napoleon-worts; the latter being represented by a tree of peculiar character. To these, as well as to many others, the word *Wort* does not appear very appropriate. But for many families possessing no special features, either in name, character, or properties, no suitable English name can be devised. To meet this, he changes the termination of the scientific name, thus imparting to it an English reading: for example, Magnoliaceæ, *Magnolads;* Menispermaceæ, *Menispermads;* Iridaceæ, *Irads.* Even families with good English names may be called *ads;* thus the Lily family, *Lilyads;* the Primrose family, *Primulads,* &c.

From these names it is common to form adjectives, by changing the termination to *ous:* thus the family

Umbelliferæ are called *Umbelliferous* plants; Cruciferæ, *Cruciferous* plants; and Coniferæ, *Coniferous* trees. In noting individual species, as parsley, it is called an *umbelliferous herb;* the raspberry, a *rosaceous shrub;* and the elm, an *ulmaceous tree.*

Many families consist of only one or two species, generally having special characters which render it difficult to determine their relationship. Some writers view all such as surviving forms of series, the intermediate links of which have in the progress of ages become extinct. To judge them by the Darwinian theory of natural selection, they appear rather to represent special advanced centres, from which intermediate forms yet remain to be developed, as explained at page 73.

Considering that the Vegetable Kingdom consists of about 100,000 species, the difficulty of classifying such an immense host must be evident; but towards this modern investigation has done much. It is only necessary for me now to give an account of the Linnæan and natural systems, of which the following is a general outline.

CONSPECTUS OF THE LINNÆAN SYSTEM.

The names of the classes and orders are a compound of two Greek words; thus, Monandria, *mono,* one; *andria,* man, the stamens. Monogynia, *mono,* one; *gyne,* woman, the pistils. The first thirteen classes are founded on the number of stamens, and the order on the number of pistils.

* *Stamens free.*

Class I.—**MONANDRIA.** *Flowers with one stamen.*

Order.—**Monogynia.** *One pistil.* *Ex.* Indian shot, marestail.

Order.—**Digynia.** *Two pistils.* *Ex.* Water starwort.

CLASS II.—**DIANDRIA.** *Flowers with two stamens.*

Order.—**Monogynia.** *Ex.* Privet, lilac, phillyrea, jasmine.

CLASS III.—**TRIANDRIA.** *Flowers with three stamens.*

Order.—**Monogynia.** *Ex.* Valerian, crocus, corn flag.

Order.—**Digynia.** *Ex.* Wheat, and most of the grasses.

CLASS IV.—**TETRANDRIA.** *Flowers with four stamens.*

Order.—**Monogynia.** *Ex.* Scabious, woodroof, and nearly the whole of the Protea family.

Order.—**Tetragynia.** *Ex.* Holly.

CLASS V.—**PENTANDRIA.** *Flowers with five stamens.*

Order.—**Monogynia.** *Ex.* Forget-me-not, borage, potato, primrose, cyclamen, pimpernel.

Order.—**Digynia.** *Ex.* Swallow-wort, gentian, and the whole of the Umbel family.

Order.—**Trigynia.** *Ex.* Elder, laurestinus, tamarisk, sumach.

Order.—**Tetragynia.** *Ex.* Grass of Parnassus.

Order.—**Pentagynia.** *Ex.* Flax, sundew, thrift.

CLASS VI.—**HEXANDRIA.** *Flowers with six stamens.*

Order.—**Monogynia.** *Ex.* Snowdrop, daffodil, hyacinth, lily, aloe.

Order.—**Trigynia.** *Ex.* Colchicum, dock.

Order.—**Polygynia.** *Ex.* Water plantain.

CLASS VII.—**HEPTANDRIA.** *Flowers with seven stamens.*

Order.—**Monogynia.** *Ex.* Horse-chestnut.

CLASS VIII.—**OCTANDRIA.** *Flowers with eight stamens.*

Order.—**Monogynia.** *Ex.* Evening primrose, fuchsia.

Order.—**Trigynia.** *Ex.* Buck wheat.

CLASS IX.—**ENNEANDRIA.** *Flowers with nine stamens.*

Order.—**Monogynia.** *Ex.* Sweet bay.

Order.—**Trigynia.** *Ex.* Rhubarb.

Order.—**Hexagynia.** *Ex.* Flowering rush.

CLASS X.—**DECANDRIA.** *Flowers with ten stamens.*

Order.—**Monogynia.** *Ex.* Rue, rhododendron, strawberry tree.

Order.—**Digynia.** *Ex.* Saxifrage, pink (single flowers), soap-wort.

Order.—**Trigynia.** *Ex.* Corn campion, catchfly.

Order.—**Pentagynia.** *Ex.* Stonecrop, lychnis.

CLASS XI.—**DODECANDRIA.** *Flowers with eleven to twelve stamens.*

Order.—**Monogynia.** *Ex.* Lythrum.

Order.—**Digynia.** *Ex.* Agrimony.

Order.—**Trigynia.** *Ex.* Mignonette.

Order.—**Dodecagynia.** *Ex.* House-leek.

CLASS XII.—**ICOSANDRIA.** *Flowers with more than twelve, or twenty or more stamens attached to the calyx.*

Order.—**Monogynia.** *Ex.* Cactus, syringa, myrtle, peach, apricot, plum, cherry.

Order.—**Di-Pentagynia.** *Ex.* Medlar, hawthorn, apple.

Order.—**Polygynia.** *Ex.* Strawberry, rose.

Class XIII.—**POLYANDRIA.** *Flowers with numerous stamens, not attached to the calyx, generally seated below the ovary.*

Order.—**Monogynia.** *Ex.* Celandine, water-lily, gum cistus.

Order.—**Digynia.** *Ex.* Pæony.

Order.—**Trigynia.** *Ex.* Larkspur, monkshood.

Order.—**Pentagynia.** *Ex.* Columbine.

Order.—**Polygynia.** *Ex.* Magnolia, anemone, virgin's bower, ranunculus.

Class XIV.—**DIDYNAMIA** (*dis*, twice; *dunamis*, power). *Flowers with four stamens, two short and two long;* the meaning being the superiority of two.

Order.—**Gymnosperma** (*gymnos*, naked, *sperma*, seed). Seeds naked, not enclosed. *Ex.* Thyme, hyssop, lavender, and nearly the whole of the mint family.

Order.—**Angiosperma** (*aggeion*, a vessel, *sperma*, seed). The seeds enclosed in a seed vessel. *Ex.* Foxglove, monkey flower, verbena.

Class XV.—**TETRADYNAMIA** (*tetra*, four; *dunamis*, power; the superiority of four). *Flowers with six stamens, four long and two short.*

Orders.—**Siliculosa and Siliquosa.** The seed pods differing only as regards length. *Ex.* Wallflower, stock, lady's-smock, and the whole of the Cabbage family. This is a perfect natural class.

** *Stamens united.*

Class XVI.—**MONADELPHIA** (*monos*, one, *adelphos*, brother). *Flowers with stamens united in one body.*

Order.—**Triandria.** *Ex.* Tiger flower (*Tigridia*).

Order.—**Pentandria.** *Ex.* Passion flower.

Order.—**Heptandria.** *Ex.* Pelargonium.

Order.—**Decandria.** *Ex.* Geranium. This class also contains a great number of genera belonging to the Pea family.

Order.—**Polyandria.** *Ex.* Mallow, hollyhock.

Class XVII.—**DIADELPHIA** (*dis*, twice, *adelpho*, a brother). *Flowers with stamens in two bundles.*

Order.—**Hexandria.** *Ex.* Fumitory.

Order.—**Octandria.** *Ex.* Milkwort.

Order.—**Decandria.** *Nine stamens united, and one free. Ex.* Liquorice, French honeysuckle, pea, kidney bean.

Class XVIII.—**POLYADELPHIA** (*polys*, many, *adelphos*, a brother). *Flowers with stamens collected in several bundles.*

Order.—**Polyandria.** *Ex.* St. John's wort, orange.

Class XIX.—**SYNGENESIA** (*syn*, union). *Flowers with five stamens united by their anthers.*

Order.—**Æqualis.** *Flowers compound, consisting of many florets, all hermaphrodite. Ex.* Sow-thistle, lettuce, dandelion, thistle.

Order.—**Superflua.** *Florets of disk hermaphrodite, the rays bearing pistils. Ex.* Groundsel, cineraria, daisy, dahlia.

Order.—**Frustranea.** *Florets of the disk hermaphrodite, of the ray sterile. Ex.* Sunflower.

Order.—**Necessaria.** *Florets of the disk with stamens, of the ray with pistils. Ex.* Marigold.

Order.—**Segregata.** *Florets hermaphrodite, separating individually. Ex.* Globe thistle.

CLASS XX.—**GYNANDRIA** (*gyne*, a woman, *andria*, a man). *Stamens and pistil borne on a column.*

Order.—**Monandria.** *Ex.* The whole of the Orchis family.

*** *Stamens in one flower, and pistils in another.*

CLASS XXI.—**MONŒCIA** (*monos*, one, *oikos*, house). *Stamens and pistils in separate flowers borne on the same plant.*

Order.—**Triandria.** *Ex.* Buckweed, sedges, Indian corn.

Order.—**Tetrandria.** *Ex.* Birch, box, nettle, aucuba.

Order.—**Pentandria.** *Ex.* Prince's feather.

Order.—**Hexandria.** *Ex.* Cocoa-nut and other palms.

Order.—**Polyandria.** *Ex.* Begonia, burnet.

Order.—**Monodelphia.** *Ex.* Gourds, bryony, palma Christi.

CLASS XXII.—**DIŒCIA** (*dis*, twice, *oikos*, house). *Stamen and pistil flowers on separate plants.*

Order.—**Diandria.** *Ex.* Willow, vallisneria.

Order.—**Triandria.** *Ex.* Date-palm.

Order.—**Tetrandria.** *Ex.* Mistleto, sea-buck-thorn.

Order.—**Pentandria.** *Ex.* Hop, spinach, hemp.

Order.—**Hexandria.** *Ex.* Oil palm, doum-palm, Palmyra palm.

Order.—**Octandria.** *Ex.* Poplar.

Order.—**Polyandria.** *Ex.* Zamia, cycas.

CLASS XXIII.—**POLYGAMIA** (*polys*, many, *gamos*, marriage). *Stamen and pistil flowers separate, or with hermaphrodite flowers on the same or on separate plants.*

Order.—**Monœcia.** *Ex.* Sensitive and humble plants.

Order.—**Dicœcia.** *Ex.* Ash, fan-palm. *Obs.* The characters which distinguish the three last named classes from each other are not always constant; different plants of the same species being sometimes monœcious, dicœcious, or polygamous. Androgynous is a general term applied to plants of these three classes.

Class XXIV.—**CRYPTOGAMIA** (*kryptos*, concealed, *gamos*, marriage). *Flowerless plants, without visible stamens or pistils.*

Order.—**Filices.** *Ex.* The Fern family.

N.B. See Natural families.

Order.—**Musci.** *Ex.* The Moss family.

Order.—**Hepaticæ.** *Ex.* Marchantia and jungermannia.

Order.—**Lichens.** *Ex.* The Lichen family.

Order.—**Algæ.** *Ex.* The Seaweed family.

Order.—**Fungi.** *Ex.* The Fungus family.

The above is a general exposition of the Linnæan system, and as the meaning of the names of the classes conveys to the mind their character, further explanation is unnecessary.

On beginning to study this system, the first thing is for the student to make himself familiar with the names and meaning of the classes and orders, which should be followed up by an examination of the flowers of some of the plants or others named as examples under each class.

On becoming familiar with the classes and orders, the next step is the study of genera and species, the characters of which being founded on special terms will be best

explained by quoting the Linnæan character of two allied genera; for example, *Ranunculus* and *Caltha*, belonging to the class Polyandria and order Polygynia.

Ranunculus.

Gen. Char.—*Calyx*, 5 phyllus. *Petala* 5, intra ungues poro mellifero. *Semina*, nuda.

In English the above means that the calyx consists of 5 sepals; corolla, 5 petals, each having a honey-bearing pore at their base, and the seeds naked.

Caltha.

Gen. Char.—*Calyx* 0. *Petala* 5—8. *Nect.* 0. *Caps.* plures, polyspermæ, intus dehiscentes.

This means that there is no calyx, the corolla consists of five to eight petals, destitute of nectary, the honey-bearing pore, and that it has many seed vessels opening on the inner side, each containing a number of seeds.

Both these genera contain a number of species, each separately described, of which the following is an example, being the specific character of two closely allied species of *Ranunculus*, namely:—

R. acris.—Calycibus patulis, pedunculis teretibus, foliis tripartito-multifidis; summis linearibus.

R. bulbosus.—Calycibus retroflexis, pedunculis sulcatis, caule erecto multifloro, foliis compositis.

The most important distinction between these two species is in the peduncles of the first being plain, and of the latter channelled.

It is proper to explain that Linnæus and other early botanists frequently erred in calling fruit seed; for in-

stance, in the character of *Ranunculus* what is termed seeds are in reality seed-vessels, each containing a seed. (See Fruit.)

By studying the above he will soon become familiar with the principles of the Linnæan system and gain a considerable knowledge of the structure of flowers, which will greatly aid him in the study of plants under their natural families.

CONSPECTUS OF THE NATURAL SYSTEM.

DIVISION I.—**CRYPTOGAMS.** *Flowerless plants, organs of reproduction hidden, being invisible to the naked eye.*

CLASS I.—**Thallogens.** *Ex.* Fungi, algæ (seaweed), lichens (fig. 10).

CLASS II.—**Acrogens.** *Ex.* Mosses, club mosses, ferns (fig. 11).

DIVISION II.—**PHÆNOGAMS.** Flowering plants, with visible stamens and pistils.

CLASS III.—**Endogens.** *Ex.* Grasses, palms, bananas, lilies (fig. 12).

CLASS IV.—**Gymnogens.** *Ex.* The cycad, fir and yew families (fig. 13).

CLASS V.—**Rhizogens.** *Ex.* Rafflesia and balanophora.

CLASS VI.—**Exogens.** All trees, shrubs and herbs with net-veined leaves (fig. 14).

It has been shown that several of the Linnæan classes are what is termed natural, yet the greater number consist of plants differing widely in character and appear-

ance. Be that as it may, it must be admitted that natural families also consist of plants of very different habits and appearance. Snowdrop and American aloes for instance being associated in the same family, and clover and acacia tree in another. But although such is the case, they nevertheless agree in the character of their flowers and fruit. It must, however, be understood, that in any number of species constituting a family, there are nevertheless often one or more which deviate in some particular point from its normal character, as—to have opposite leaves instead of alternate, while agreeing in every other character. Therefore in describing and characterizing families it is necessary to use modifying words, as *sometimes, rarely, often.*

According to the Linnæan system, by simply examining the stamens and pistils of any plant its class and order can be readily determined. But to be able to refer plants to their respective natural families much more study is required, as the following will show. Linnæus being aware that his sexual system was quite artificial, with the knowledge of the principles of natural classification as pointed out by Ray, he in 1751 gave his views of a natural arrangement, under which he classed all plants then known to him under sixty-eight orders. But the credit of scientifically defining the principles of natural classification is due to A. L. Jussieu, a French botanist, who in 1789 published a "Genera Plantarum," or Natural System of Plants, in which the whole are arranged under 100 natural orders, comprehended under 15 classes, the primary characters being derived from the seed having one, two, or no cotyledons, the corolla being monopetalous or polypetalous, and in the stamens being hypogynous, epigynous or perigynous, which have

continued to be permanent characters in all succeeding natural arrangements. This system was patronized in France, and was adopted by the celebrated botanist, M. De Candolle, who in 1819 published his amended "Elementary Theory of Botany," in which he classified flowering plants under 150 natural families. But Dr. Lindley, in his "Vegetable Kingdom," 1846, has, by separating genera from these orders, increased the number to 303, which he forms into 56 groups called alliances, the characters of which with those of the families are founded on a general view of the whole of the organisms of plants, which will be best understood by quoting an example.

"Alliance XXXII. The Ranal Alliance.

"*Hypogynous Exogens, with monodichlamydeous flowers, sutural or axile placenta, numerous stamens, and a minute embryo enclosed in a large quantity of fleshy or horny albumen.*

Order, Ranunculacea.

"Herbs, or rarely shrubs. Leaves alternate or opposite, generally much divided, with the petiole dilated and forming a sheath half clasping the stem. Stipule-like processes occasionally present. Hairs (if any), simple. Inflorescence variable. Flowers usually conspicuous; if apetalous, then with the sepals large and gaily coloured. Sepals 3—6, hypogynous, deciduous, generally imbricate in æstivation, occasionally valvate or duplicate. Petals 3—15, hypogynous, in one or more rows, distinct, sometimes deformed, in some cases missing. Stamens 0 0 (very rarely definite), hypogynous; anthers adnate. Carpels numerous, 1-celled or united into a single many-celled pistil; ovary one or more seeded, the ovules sutu-

ral; styles simple; ovules anatropal. Fruit either consisting of dry akenia, or baccate with one or more seeds; or follicular with one or two valves. Seeds albuminous; when solitary, either erect or pendulous. Embryo minute. Albumen horny."

The reader may here truly exclaim, "Save me from being obliged to study botany." But these characters are perfectly legitimate, and plants cannot be scientifically studied without them. It is nevertheless possible to obtain a practical acquaintance with the families of plants without the necessity of having to study the more obscure parts of their organism. For that purpose I have, in drawing up the characters of the families, only taken into account the most obvious parts, especially as regards their mode of growth and general habit, only noticing (and not in all cases) the parts of the flower and nature of the fruit, which I consider will be sufficient to convey a general idea of the plants constituting each family.

In compiling this part of the work, I have been greatly assisted by the opportunities afforded me at Kew of examining a greater or less number of species belonging to the families of flowering plants enumerated by Dr. Lindley, of only thirty of which I have not seen examples in a living state.

Admitting the characters of the classes and orders (families) of the natural system to be more complex and intricate than the Linnæan, nevertheless on acquiring a knowledge of the principles on which it is established, it will be found to possess merits much beyond that of the Linnæan. For as regards the latter, no decision can be arrived at unless the plants are in flower. But on becoming practically acquainted with the general habit and nature of any number of species

belonging to well marked families, other species, although not in flower, can in general by their likeness be referred to their respective families; and in many cases, aided by the sense of taste, scent, and touch, a twig, a single leaf, flower, or fruit, is often sufficient data for that purpose.

To assist the practical amateur to attain that degree of knowledge, I have drawn up the following arrangement of flowering plants in as simple a manner as the scientific nature of the subject reasonably permits. Presuming that the preceding pages have been duly studied, the next step is to examine and compare plants in flower with the characters of the principal divisions and sections of the classification, which will lead the student to determine their places in their sequence of arrangement, and in many cases to their special families.

In the selection of examples, I have, as far as possible, chosen species well known by popular English names, or for their products; and with regard to the botanical names I have, in order to avoid perplexing the learner with synonyms, in most cases adopted the original Linnæan, or such modern name as is best known, the synonym being sometimes included in parentheses. The families of special plants, or products having popular names, will be readily found by reference to the index. By diligent practical application of the above, the amateur student cannot fail, during the course of a year, to become acquainted with the special characters and features of the principal families represented in this country by natives or exotics; beyond that point this work does not profess to teach.

Botanists not only entertain different views as to the relationship of families, but also in their mode of commencing their systems; some begin with Cryptogams,

the lowest degree of plant development, passing upwards to the highest, considered to be represented by the Ranunculus, Poppy, and Magnolia families. Others commence with the latter, and pass downwards to the lowest.

In the following arrangement, I have adopted Dr. Lindley's view of classification, as given in his "Vegetable Kingdom;" but in consequence of the great importance attached by him to the position and character of the ovules, embryo, and the presence or absence of albumen in the seed in determining affinities, families related in every respect, but differing in the nature of the ovule, etc., are placed far apart. Admitting these characters to be of great importance scientifically, as they are not evident to common observation, I have deviated from his sequence of arrangement by bringing into proximity families placed by him in different alliances; thus in many cases arranging them in accordance with the position they hold in the systems of Jussieu and De Candolle.

I have now given a general view of the organisms and functions of plants, which I trust will be sufficient to enable the amateur student to acquire a knowledge of the principles of Botany. It is, however, necessary to explain that the subject separates into two branches, which to a certain extent may be independently studied. The first is called *Phytology*,* and embraces the organs of growth and reproduction, which with classification constitute descriptive and systematic botany—that is, naming, classifying, and technically describing plants.

The second consists in the microscopical examination of the structure of plants, which is termed physical bo-

* From the Greek word *phuton* (phyton), a plant.

tany, or vegetable physiology, and forms not only part of the legitimate study of the systematic botanist, but is also independently studied by microscopic observers in general, affording a high degree of intellectual pleasure, not only in beholding the varied wonders and works of nature in the structure of plants, but also assisting to explain some obscure functions of life. It is also of great practical use in detecting the frauds in adulterations of food, woven fabrics, the qualities of timbers, and the like; as well as being of great assistance to the chemist and pharmaceutist.

By the first the student is furnished with means for ascertaining the names of plants and their position in the system. While the second is of importance in assisting him to ascertain the virtues and economical uses of plants, which we now proceed to consider.

PART II.

THE FAMILIES OF PLANTS SYSTEMATICALLY ARRANGED, WITH A DESCRIPTION OF THEIR CHARACTERS, PROPERTIES, USES, &c.

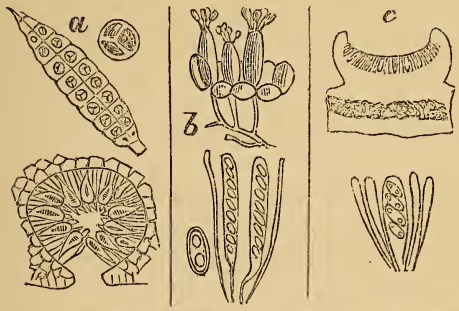
DIVISION I.—CRYPTOGAMS.

FLOWERLESS plants, consisting of cellular tissue only. Organs of fructification obscure, generating microscopic spores, contained in cells, cysts, or cases imbedded in the substance, or seated on the surface of the plant, or borne on stalks. This division contains the whole of the plants comprehended by Linnæus in the class Cryptogamia.

CLASS I.—THALLOGENS.

This class comprises all plants known by the names of *Lichens, Sea-weeds, Confervæ,* and *Fungi*; the higher forms consisting of leafy expansions, called fronds—the lower of microscopic globules, or jointed filaments. Amongst them the lowest types and most simple forms of vegetation are to be found. They are generally mucilaginous, soft or gelatinous, many being of special interest as useful for food, and in the arts. The discoveries of late years, not only in the number of new species, but also in their structure, have led botanists to separate them into distinct families.

Fig. 10.



a. Spore-cases and spores of Algæ ; *b*. Ditto of Lichens ; *c*. Ditto of Fungi.

The Brittlewort Family.

(Diatomaceæ.)

This family consists of microscopical crystalline, brittle, jointed bodies united in straight or curved lines or branched, often separating into pieces and presenting very different forms, being the lowest organisms of the vegetable kingdom.

The apparent animal motion seen in some of these plants has led to the idea that they belonged to the animal kingdom, but chemical analysis proves them to be vegetable. They appear either in the form of slime on moist earth, stone walls, or in damp, shady places, and even on damp glass, also on stones in fresh water, and on rocks in the sea, often floating and imparting a green, and even a red colour, to the latter, as in parts of the Red Sea, whence its name. Above 450 species have been described and arranged under 45 genera. They exist in all parts of the world, even in the Polar seas, but are not of any special use to man.

The Conferva Family.

(Confervaceæ.)

This family consists of globose, hair, thread, or broad leaf-like bodies, growing on stones and rocks in fresh or salt

water, on the surface of moist stones, or other bodies, sometimes like slime, or in jelly-like masses. Above 350 species are enumerated and arranged under about 50 genera. Purple laver (*Porphyra vulgaris* and *P. laciniata*), green laver (*Ulva latissima* and *U. compressa*), are broad riband-like plants, found on many parts of the rocky coasts of this country. They are used as condiments.

Star jelly (*Nostoc commune*). A gelatinous substance springing up in round patches after rain. *Nostoc edule* is wholesome, and in China is dried, and used in making soups.

In 1855 several square miles in the Bombay Presidency were covered with *Nostoc collinum*. The natives called it meat, and considered that it fell from heaven. The spores are supposed to float in the air, and alighting on congenial surfaces where the temperature, and moisture are favourable, spring suddenly into existence, as the perfect plant.

Several species of *Confervæ* are extremely troublesome in ornamental ponds, lakes, and plant aquariums, covering the surface with a fœtid scum, or flannel-like masses.

Ball Conferva (*Conferva ægropila*). A native of lakes in many parts of Europe. It is in the form of a ball, of a green colour, and when full grown is about three to four inches in diameter, being composed of successive growths of entangled filaments forming a firm spherical mass.

The different species of *Scytonema*, although microscopic in their character, nevertheless, from the great extent of surface they occupy, and their different colours of red, green, and black, form conspicuous objects in nature.

In Angola (West Africa), the mountain rocks during the rainy season become striped, and ultimately covered as with a black mantle; this singular appearance being due to the rapid growth of *Scytonema chorographicum*. In the dry season it peels off like paper, and the rocks assume their natural grey tint. In this country during summer, water in stagnant ponds becomes of a green colour, which is caused by a microscopic globular alga that increases rapidly, and floats in clusters of such density as to give the water the

appearance of green-pea soup. It has received the name of *Clathrocystis æruginosa*.

Red Snow (*Protococcus nivalis*). This singular substance consists of microscopic globules, covering large tracts of snow in the Arctic and Alpine regions with patches of a bright red colour, which after pressure with the foot or sledge, assumes the appearance of blood. It is rapidly generated, and is in some parts believed by the superstitious to be showers of blood.

The Dulse Family.

(Ceramiaceæ.)

Sea plants, generally of a rose pink or red colour, varying much both in size and form, some being like hairs, others leafy, entire, more or less lobed, palmate, or much divided, like parsley, or endive. The family consists of about 700 species, divided amongst nearly 100 genera. They are principally found in the northern hemisphere.

A considerable number contain gelatine, which is used for food, and other purposes.

Dulse (*Rhodomenia palmata*). A common species growing abundantly on the rocky shores of this country, and also in Ireland, being found at the lowest ebb of the tide. It is of a red colour, and is eaten in a raw state as a salad, and considered extremely beneficial in scrofulous complaints, its efficacy being no doubt due to the iodine it contains.

Carageen Moss (*Chondrus crispus*). This, like the last, is common on the rocky coasts, and is extensively collected as an article of commerce. It is of a livid purple, or greenish yellow colour, and contains a considerable quantity of gelatine, which is used for food.

C. mamillosus answers the same purpose. When dry they retain their virtues for a long period.

Ceylon Moss (*Gracilaria lichnoides*). A delicate white sea-weed found growing upon rocks in the Indian and Malayan seas, and known also by the Malayan names of

Agar Agar, or Agal Agal. It is largely collected and made into a jelly much resembling that obtained from calves' feet, and forms an extensive article of trade at Singapore and Borneo, constituting part of the cargo of the Chinese junks on their return voyages. It is also used as a varnish, more especially for the paper employed in the manufacture of Chinese lanterns, to which it imparts a yellow tinge.

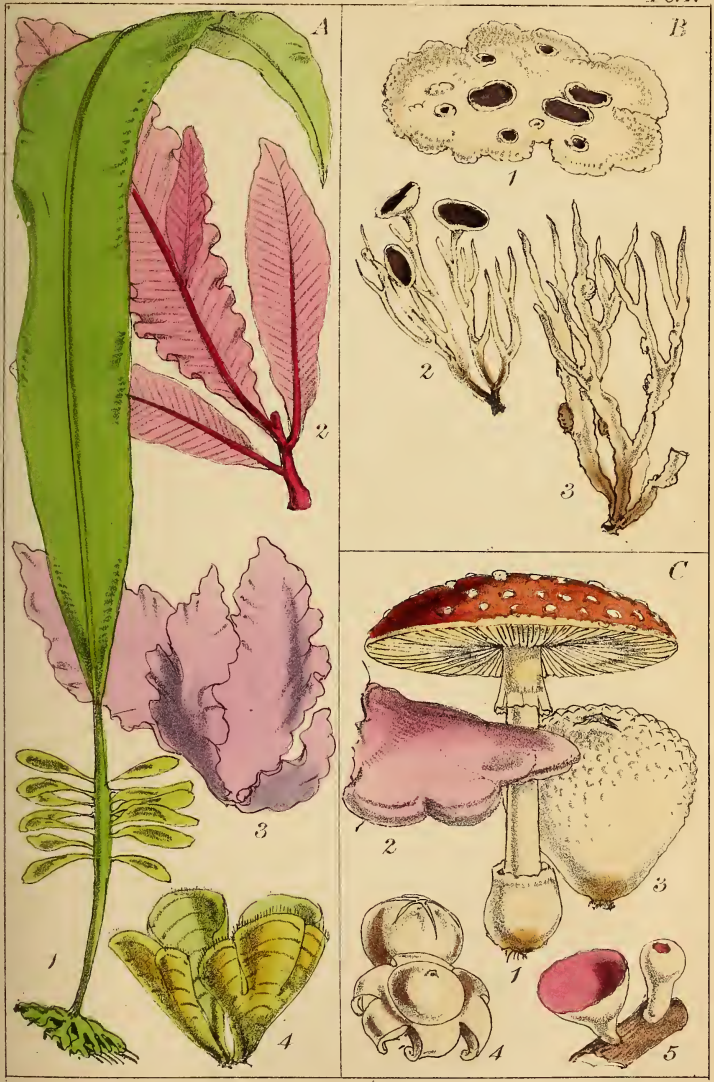
Plocaria tenax. Native of the Indian and Chinese seas. It contains much gelatine, and is considered to be the chief substance of which the sea-swallows compose their nests. The process imparts to them a peculiar character, and they form an important article of commerce among the Chinese, by whom they are considered a great luxury.

The Seaweed Family.

(Fucaceæ.)

Plants inhabiting the sea, or growing in fresh water. In general they consist of thick, firm, leathery *fronds* of a brown, olive, green, or red colour, narrow or broad, entire or variously divided, their stems being solid or hollow, often of a considerable thickness, some slender and of a great length; when dried often becoming hard and horny. In some species their reproductive spores are borne in bladder-like cases. This extensive family forms the forests and shrubberies of the ocean. About 450 species are enumerated, abounding in all seas, even to high latitudes.

Wrack. During storms the force of the waves uproots large quantities of seaweeds of different species, which are wafted on shore and left by the receding tide. They are chiefly such strong-growing species as *Fucus vesiculosus*, *F. nodosus*, *F. senatus*, *Laminaria digitata*, and *L. bulbosa* (known also as tangle). In former years the collecting, drying, and burning of "wrack" furnished employment to large numbers of people in Scotland and Ireland. The ashes contain an alkali called "kelp," used in the manufacture of soap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and glass. Since "barilla" has been used for these purposes the burning of sea-wrack has almost ceased. From the alkali of sea-weeds an important chemical substance called "*iodine*" is obtained, which is well known in medicine and the arts as a powerful absorbent. In agricultural districts, "*wrack*" is eagerly sought after for manure; its virtue as such depends principally on the salt it contains.

Gulf-weed (*Sargassum bacciferum*). A deep-sea weed, its fronds rising from a great depth, and covering the surface of the ocean for thousands of square miles. It is found in the meridian of 40° W., and between the latitudes of 20° and 45° N.

Trumpet sea-weed (*Laminaria buccinalis*). The stems of this species attain the height of six or more feet, being narrow at the base but widening upwards, and bearing long, broad, leafy fronds, which float on the surface. The stems are cut into lengths, and used as a curiosity trumpet. Deprived of its alkaline properties by a chemical process, it becomes tough and plastic, like morocco leather, and is then used for binding albums. By other processes it becomes hardened, and is then used for walking-sticks, whips, and knife-handles; also as a substitute for stag-horn.

The Lime-wort Family.

(Characeæ.)

Small fresh-water plants, having articulated stems and branches which grow in whorls, either transparent or coated with carbonate of lime. The organs of reproduction consist of globose nut-like bodies of two sizes, covered by spiral tubes, which give them a striated appearance.

This singular family comprises about thirty described species, found in stagnant water in most parts of the world. They grow very rapidly, and soon fill shallow waters, sometimes forming great masses which decay and become offensive, causing malaria in many districts, as in the Pontine marshes near Rome. They have no known uses, and must

only be regarded as botanical curiosities, more especially as they beautifully illustrate the circulation of the sap, such being readily seen under a microscope in the joints of their stems. *Nitella translucens* is best suited for that purpose, but as *Chara vulgaris* is the most common, it may be substituted after the lime with which it is coated is removed. By shutting up a portion of this species in a phial containing a little water, it will grow, adhering to the sides of the glass, and be perfectly free from the lime. There are six species natives of this country.

The Fungus Family.

(Fungi.)

This family is represented by mushrooms, toadstools, moulds, mildews, dry-rot and such like plants, which are found on living, or more abundantly on decayed animal or vegetable matter. The number of so-called species is beyond calculation; indeed it seems as though new forms spring into existence according to the nature of the substances upon which they grow. They almost appear to be organisms of chance, many coming to perfection in a single night. In such a vast assemblage of species great diversity of size and form is to be found, from microscopic globules to the gigantic *Boletus* which, by the rapidity and power of its growth, is capable of raising heavy weights. A number of species of *Erysiphe* appear in the form of spots or blotches on trees and shrubs, and are very conspicuous in the autumn on the leaves of the maple, while a number of species of *Sclerotium* grow upon leaves and dead branches after they have fallen. Mildew and mould have the power of destroying organized bodies, living or dead, thus becoming a great pest to the human race. Their spores float in the air and are supposed to transmit, and to be the actual cause of, contagious diseases. Their minute proportions may be imagined when it is stated that a square inch will contain millions. Although so very minute they vary considerably in form and size, being globose,

oval, oblong, banded, smooth, warted, or spinose. Fungi are found in all parts of the world, but most abundantly in moist places in temperate countries. The difference between moulds, fungi, and some filamentous confervæ, is not evident to common observers, and in some cases it is supposed that the same organisms assume the characters of either under different influences; there is, however, one important distinction, viz., that fungi never grow in water like confervæ, and are rarely green, being destitute of chlorophyl.

The study of Fungi is termed Mycology. Of those possessing the greatest degree of development, as in agarics and their allies, the principal parts are known by the following special names. *Mycelium*, common to all Fungi, consists of hair, or thread-like filaments growing under, or upon the surface of the ground or other bodies, and from which, under favourable circumstances, perfect plants are produced. In the common mushroom it is white and thread-like, and is called "spawn," the perfect plant first appearing like small round knobs, which, as they increase in size, are seen to be covered with a membrane called the *volva*, or veil; this is burst by the growth of the young mushroom which it contains, the latter when full grown consisting of an umbrella-like cap called the *pileus*, borne on a stalk (*stipes*). The pileus as seen from below is composed of numerous lamellæ (*hymenium*), known as the gills, and in these the spore cases (*asci*) are embedded. The Rev. M. J. Berkeley, the greatest authority on this subject, estimates the number of species at about 4000, of which 2380 are natives of Britain. Many are used for food, while many more are in the highest degree poisonous. The common mushroom (*Agaricus campestris*) is so well known that it is not necessary to describe it. It is found abundantly in pastures during the summer and autumn months. The horse mushroom (*A. arvensis*) is larger than the preceding, some specimens being eighteen inches in diameter. This species is largely used for making ketchup.

Fairy Rings.—In autumn several species of fungi spring up suddenly on grassy lawns, growing in rings of greater or

less diameter. The superstitious formerly supposed these rings were produced by some supernatural agency, and believed that spirits called fairies held their midnight revels within the circles. Their formation is, however, very simple, natural, and easily accounted for. A solitary tuft first appears, performs its functions, and dies. The next season another patch appears outside the spot occupied by the original, forming a small ring, and this is repeated from year to year, the ring increasing in size. The decay of the previous fungi rendering the soil unfit for the reproduction of the same species, the mycelium or spores find fresh soil on the external margin of the ring, and again germinate. One species of fairy-ring fungi, *Marasmius Oreades*, is edible, and is called the champignon.

Morel (*Morchella esculenta*). A native of this country, is found growing in woods and pastures, especially where charcoal has been burnt. It attains the height of from three to four inches, and consists of a smooth, white, cylindrical stem, having a hollow spherical cap of a pale brown or grey colour, and adhering to the stem by its base. It is marked with deep pits all over its surface, and is used in cookery, both fresh and also when dried. Truffle (*Tuber cibarium*) is found principally in Kent and the neighbouring counties. It is of a spherical shape, seldom exceeding the size of a walnut, and when old is of a black colour veined with white. It grows under the surface of the ground in calcareous soils, generally under trees. It was formerly sought after by means of dogs trained for the purpose, but now more generally it is discovered by a particular species of fly hovering over the place of its growth, being attracted by its odour. Truffles are used in cookery, forming a much esteemed and expensive dish. *Helvella esculenta*, *H. crispa*, and *H. lacunosa* grow something like mushrooms, being generally found in woods. Some are wholesome when cooked, while others of the same genus are poisonous. *Boletus edulis* grows upon trees, and sometimes attains a large size; it is said to be

wholesome when cooked, and in some parts of Germany is preferred to mushrooms.

Fly Agaric (*Amanita muscaria*). A common fungus of a red colour; when steeped in syrup it is used as a poison for flies. It is of an intoxicating nature, and in Kamtchatka, and other parts of Northern Asia, is used instead of ardent spirits. When dried it loses its intoxicating and poisonous properties, and is then stored for winter food. Puff-ball (*Lycoperdon bovista*, or *L. giganteum*) commonly grow in dry pastures, the chief difference between the two depending on size, which varies from a few inches to a foot or more in diameter, some weighing as much as 6 lbs. They are of a brown colour and globular form, solid when young, and are then wholesome, cut in slices, and fried in butter. When fully ripe and pressed with the hand, or trodden on, they emit their spores in a dusty cloud resembling smoke. German tinder (*Amadou* or *Moxa*). A substance obtained from *Polyporus fomentarius*, which grows on trees in this country, but more abundantly in Germany, where it is collected in large quantities, and forms a considerable article of trade. It is cut in slices and beaten out, forming large sheets like thick felt, which is used for warm underclothing, and when mixed with saltpetre forms the substance known as German tinder.

Some fungi are phosphorescent, the most remarkable being *Rhizomorpha subterranea*, which grows in mines, and gives to those of Dresden quite an enchanted appearance. Many species emit very offensive odours, especially *Phallus fœtidus*, which grows in woods and damp shady places. Dry-rot consists of the mycelium or spawn of several species of *Boletus*, and other fungi, which under certain circumstances of heat and moisture attack woodwork in ships and houses, growing in the dark, and rapidly increasing in bulk, first covering the surface with a layer of thread-like filaments, which are continually being added to, and ultimately forming a thick, leathery substance, as is often found behind the partitions of

walls and under floors. It penetrates the wood in all directions, in many cases doing irreparable mischief before being observed. The perfect plant is only occasionally developed through crevices. The following species are active dry-rot operators:—*Polyporus hybridus*, *Thelephora puteana*, *Merulius lacrymans*, and *M. vastata*. *Peziza æruginosa* penetrates and imparts a fine green colour like verdigris to wood of which ladies' work-boxes, toys, &c., are made.

Mildew. The microscope reveals many kinds of mildew, their structure consisting of cells (*gonidia*), reproducing their like, and forming chain-like, branched filaments, which rapidly spread over vegetable substances like a thin web, and although infinitesimally small, act an important part in the economy of nature. They, with their allies the dry-rots, are powerful agents in reducing vegetable substances to their original and invisible elements. Their effects are generally limited, but when whole fields are attacked they become more serious. The most important instance is that which took place in 1846–7, when the potato plant throughout Great Britain and Ireland was suddenly smitten with a disease hitherto unknown, and the failure of the crop caused a famine in Ireland. This new disease rapidly spread itself over Europe and distant countries, and now periodically shows itself with more or less virulence in different parts of the country. As might reasonably be expected, the origin and effects of this terrible scourge led to much research and investigation, and now it is generally admitted to be caused by a mildew which has received the name of *Botrytis infestans*. Shortly after the advent of the potato disease, the grape-vine became attacked by a mildew, which showed itself in vineries until it covered the leaves and grapes to that extent that black grapes became white with the web. In a few years it was found ravaging the vineyards of Europe, causing great deterioration in the produce of grapes and quality of wine. The disease reached Madeira, producing ruin and famine in that island. Like the potato disease it has become endemic, and is known by the name of *Oidium Tuckeri*. Other field plants are also occa-

sionally attacked by mildew, such as wheat, peas, and turnips, whole fields of the latter becoming white in a single night.

The great extent and sudden appearance of mildew gives a reason for much speculation as to its origin and propagation, of which even a summary would occupy too much space here. Many species of fungi having the nature of mildew are common to fruits, as apples and pears, commencing sometimes from a wound in the skin, the jointed filaments of the fungus soon entirely enveloping the fruit. In other cases, apples, &c., without any apparent external blemish, are affected, the whole substance becoming perforated by the fibres, which soon causes them to rot. Sometimes pears perfectly sound to all appearance, are unpalatable through the presence of fungi, which renders them extremely bitter. The spots found on linen after being folded up for a long time are due to some kind of mildew.

Smut-dust (*Ustilago segetum*). A common form of mildew found on grasses, but its effects on wheat are of a formidable character, doing great injury. It affects the ear in its earliest stage, completely destroying the young grain, and causing the whole to become a swollen mass of black, sooty dust.

Bunt, or Pepper-brand (*Ustilago fœtida*). Wheat is attacked with this as by the preceding, but in this case the ear is only partially affected, some of the grains being left perfect, while that affected becomes filled with dust of a fœtid odour, distinguishing it from the smut or dust-brand which is scentless. In both cases the dust is the spores or organs by which the plants are reproduced, and with these the ground, and also the sound grains become impregnated. Experiments made by the celebrated microscopist, Francis Bauer, show that the spores are absorbed into the tissues of the plant, and carried up till they reach the ear, where they develope and multiply to the destruction of the grain.

Ergot (*Oidium abortifaciens*). A microscopic mildew common to grasses, attacking one or more of the young grains in the ear, which it affects in such a manner as to cause it to

swell into a substance very distinct from that of the grain, being solid and of a fatty nature, generally in the form of a spur, sometimes an inch or more in length. This is common to rye, whence the name "spurred" rye. In its earliest stage the surface of the spur is covered with mildew of a chalky-white colour, which moisture readily removes; hence the spurs (ergot of shops) are of a black colour, the mildew filaments being the *oidium* or true plant. The spur is very poisonous, and in Germany and other parts of Europe, where rye-bread is extensively used, it causes those who eat it to be afflicted with incurable gangrenous diseases. This led to the interference of Government to test the purity of rye before being ground. Ergot being common to grasses on which sheep and cattle browse, it is supposed to be the cause of diseases to them. Although it is of such a poisonous nature, it is a most valuable medicine.

Moulds consist of different species of *Mucor* and *Penicillium*. They are similar to mildews in their ravages, but more evident, being larger, and are often seen with their fructification on stalks like pin-heads growing on jellies, bread, cheese, &c. Yeast is the result of a species of *Mucor*, or *Penicillium*, as is also the vinegar plant, which is brought into existence by a combination of sugar, treacle, and flour. *Racodium cellare* is a curious filamentous fungus growing in wine-cellars, covering the walls and casks with a substance like felt. A mildew fungus attacks the corks of wine bottles, also the wine itself, making it what is called "ropy." Grease mould (*Mucorini phycomyces*) has the appearance of a filamentous conferva, and grows abundantly on oily walls, also on grease, destroying all fatty matter, and often causing great losses to the merchant. *Polyactis vulgaris* is a filamentous spiderweb-like mould, appearing suddenly in a single night, and spreading rapidly over moist surfaces. It is a great pest to gardeners, as it destroys low plants in propagating and store-pits.

Fungi do not confine their attacks to dead substances, but are known to grow on living animals, of which there are

several instances. Wasps are found with horn-like bodies growing out of their heads, being a species of *Sphœria*.

Sphœria Robertsii, a native of New Zealand, is found growing on the head of a caterpillar, which, on burying itself in the earth to undergo its metamorphosis, is attacked by the fungus, which rises like a spike to about six inches in height, and of course kills the caterpillar. A species similar in its habits is found in Tasmania, and *S. sinensis*, a native of China, grows in a similar manner. Silkworms are liable to be infested by a minute fungus, *Botrytis basseana*, supposed to be a changed state of an alga, *Achyla prolifera*, which destroys gold-fish, giving them quite a woolly appearance.

The Lichen Family.

(Lichens.)

Cellular plants, generally of a grey colour, growing on the earth, rocks, stones, or trees, rarely in water, varying in size and form from a grain like a pin's head to a slender filiform, or broad leafy expansion, either entire or branched. Their reproductive organs consist of circular shield-like bodies, called *scutellæ*, or cup-like cavities, either free, sessile, or borne on a stalk. They occupy extensive plains in high northern latitudes, as also rocky cliffs in the tropical zone. There are upwards of 2500 enumerated species, some few of which produce gelatine used as food, and colouring matter employed in dyeing.

Iceland Moss (*Cetraria islandica*). A foliaceous lichen, growing about six inches high, common in this country and throughout northern Europe. It is extensively collected, and made into a nutritious jelly for invalids.

Tripe de Roche, or Rock Tripe.

A name applied to one or more species of *Umbilicaria* and *Gyrophora*. They are circular in form, attached by the centre, and lie nearly flat on rocks to which they cling.

They turn black when dried, and contain a bitter principle. They have been of great utility as food to distressed Arctic navigators.

Lung Lichen (*Sticta pulmonaria*). A broad leafy species, growing on the ground in woods, generally among grass, and called by the English peasants the "Lungs of the Oak." It is used as a substitute for Iceland moss.

Peltidea aphthosa, *P. canina*, and *P. rufescens*, are similar in habit and qualities to the last.

Reindeer Moss (*Cladonia rangiferina*). An erect, finely-branched species, of a white or grey colour, growing in compact masses, about six inches high, and covering large tracts of country throughout Northern Europe and Arctic America, where it may be said to represent the herbage of more southern latitudes. It is well known as the food of the reindeer.

Tree hair (*Usnea barbata* and *Alectoria jubata*). Filamentous lichens, growing in tufts on trees, and hanging down from the branches like bunches of thread or grey hair. They are common in this country, especially in damp woods, often quite covering the trees; while in Lapland they are so abundant as to give the fir forests quite a thick, gloomy appearance.

Orchil (*Roccella tinctoria*). A foliaceous species growing in tufts on rocks. It is from two to six inches high, and differs much in breadth, which has led to several of the more distinct forms being regarded as species. It is found in all parts of the world, even on the dry rocks of Aden, and is abundant on the rocky shores of this country, often growing on perpendicular cliffs, from which situation it is collected, men being lowered with ropes, for that purpose. It has been extensively used in dyeing, and originally formed a valuable article of commerce, but like many other things of the past, lichen dyes are now being superseded by fine dyes obtained from coal-tar. The delicate chemical test called "litmus" is obtained from this, and other lichens.

Many other lichens resembling the *Roccella* in habit, but growing on trees, are found in this country. *Ramalina*

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fraxinea and *R. farinacea* are most common, and generally their growth denotes unhealthy forest vegetation. They yield but a small amount of colouring matter.

Manna (*Lecanora esculenta*). A crustaceous species of a grey or brownish colour, growing on the mountains of Armenia, and other countries of Asia Minor. At some period of its growth it becomes dried up, and is blown by the winds to a considerable distance, eventually falling, and covering the ground with a coat several inches in depth; the inhabitants suppose that it falls from heaven. In times of scarcity it is ground up with corn, and used for food. This plant is found abundantly in the desert in which the children of Israel sojourned, and is by some travellers and commentators supposed to be the substance they called manna. Showers of it have fallen in Algeria.

Cudbear (*Lecanora tartarea*). A common crustaceous lichen, formerly very extensively used in Scotland for dyeing wool.

Parmelia parietina. One of the most beautiful crustaceous lichens, covering trees, or walls with a fine yellow, or red tinge. It has been highly valued as a dye.

CLASS II.—ACROGENS.

Leafy plants, having stems with a firm central axis, which branches into the cellular laminæ forming midribs, and veins. Reproduced by spores, contained in special spore cases (*sporangia, thecæ, &c.*).

This class contains mosses, club-mosses, ferns, and horse-tails (fig. 11, *a, b, c.*).

THE MOSS AND LIVERWORT ALLIANCE.

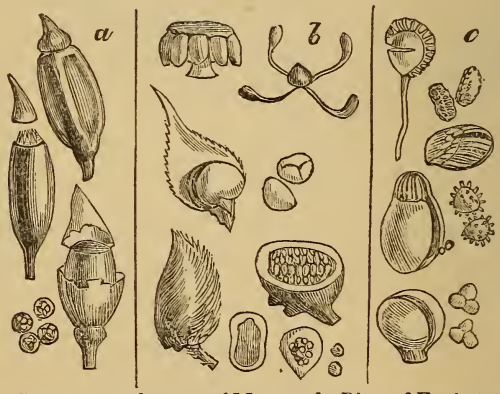
The Moss Family.

(Bryaceæ, or Musci.)

Plants with erect, or creeping, simple, or branched stems, the central axis being composed of firm, elongated

cellular tissue, generally furnished with alternate, entire, or serrated leaves, having a midrib only. Fructification of two kinds, Antheridia (*male*) and Pistilidia (*female*), the latter eventually becoming urn-shaped spore cases (*thecæ*), borne on long or short footstalks (*setæ*), opening at the apex by a lid (*operculum*), and generally covered by a deciduous, membraneous, smooth, or hairy covering (*calyptra*), (fig. 11, *a*.). Above 1000 species of this interesting family are enumerated. They have a wide geographical range, but are most abundant

Fig. 11.



a. Spore-case and spores of Mosses; *b*. Ditto of Equisetum, Lycopodium, and Marsilea; *c*. Ditto of Ferns.

in the temperate zones, although some are found in both tropical and polar regions.

In the northern parts of Europe the genus *Sphagnum* covers large bogs, and in course of time becomes converted into Peat, which is used for fuel. Above 300 species are natives of this country. Of these many are common to all localities, growing on lawns, trees, old walls, and in shady woods. Some few have leaves of a metallic hue, as the silvery Bryum (*B. argenteum*). A few are very local, the beautiful *Splachnum ampullaceum*, being found only on the dung of animals. *Schistostegia osmundacea* ornaments

caverns with its luminous golden hue, while *Cinclidotus fontinaloides* and *Fontinalis antipyretica* grow upon rocks, stones, or woodwork in running streams. Being generally destitute of economic or medicinal virtues, but few species are of use to man. Some species of Hypnum are useful for packing, and small, light brooms are made of *Polytrichum commune*.

Sphagnum is used for stuffing cushions, and for gardening purposes.

The Liver-wort Family.

(HEPATICEÆ.)

This family includes the genera *Riccia*, *Marchantia*, and *Jungermannia*, containing about 700 species described by modern botanists. These three genera are typical of as many distinct families, but it is not necessary here to consider them as such. They consist of small membraneous plants, having a distinct axis, simple or much branched, or having separate leaves. They are erect, or creeping, or lie flat upon the earth, stones, or trees, some floating in water, and all growing in moist places. Their spore cases are generally produced on footstalks, sometimes on the leafy surface of the so-called frond. They are widely distributed throughout temperate and warm regions, but have no economic properties or uses, and can only be looked upon as botanical curiosities. The genus *Jungermannia* furnishes beautiful subjects for microscopic examination.

THE FERN ALLIANCE.

The Horse-tail Family.

(EQUISETACEÆ.)

Leafless perennial plants with articulated, hollow, furrowed stems and whorled-jointed branches. Fructification generally in terminal cone-like catkins consisting of spore-cases containing spores, the latter furnished with four clavate filaments which are elastic, and on the emission of the spores

from their cases a spontaneous motion may be observed when viewed under the microscope, which continues for some time. They are found in most parts of the world, and are common in this country in ditches and waste places by road-sides. They are the only modern representatives of the remarkable fossilized remains called Calamites. They have no medical properties, but are imported under the name of Dutch rushes, and are used for polishing furniture, their usefulness in this way being due to the minute particles of flint, or silex, with which their stems are coated.

The Club-moss Family.

(LYCOPODIACEÆ.)

Plants consisting of firm, erect or creeping stems, which are simple, or branched, often flagelliform and pendulous, furnished with acerose, rusciform, or jungermannia-like sessile leaves. Spore-cases, produced either in the axils of the leaves (Fig. 11, *b*) or in terminal catkin-like spikes. This family is widely distributed, and is found in both tropical and temperate regions. In the northern parts of Britain they are not uncommon on moorlands and hillsides. They are liable to great variability under different climatic influences, which has led botanists to differ as to the probable number of species, some enumerating upwards of 400, while others do not admit more than half that number.

The spores of *Lycopodium clavatum* are highly inflammable, and have been used to produce artificial lightning-flashes in theatres. Some species from tropical America are highly hygrometrical, as *Selaginella lepidophylla*, which grows in a circular roseate form, expanding while the air is in a moist state, but rolling up like a ball when it becomes dry. It remains green and acts in this peculiar manner for years after having been gathered. About thirty years ago a great number were imported from Mexico and sold in London under the name of "Rose of Jericho," and more recently as the "Resurrection Plant." Many species of *Selaginella* have

become great favourites with amateur fern-growers. *S. serpens*, a native of Jamaica, is remarkable for a peculiar habit of changing its colour during the night, the whole plant becoming white, and when growing in a mass is visible at a considerable distance, changing again to green on the return of daylight.

The Pepper-wort Family.

(MARSILEACEÆ.)

Plants floating, or growing in water, rarely on land, having grass or trefoil-like leaves. Their spore-cases are produced either from the rhizome, or the stem, or on the footstalks of the leaves. (Fig. 11, *b*.) This small family is composed of from twenty to thirty species, the greater number being natives of temperate countries of the Northern hemisphere. They are found floating on the surface, or growing at the bottom of pools and lakes. Several species of *Isoetes* are found on land. They are of no economic use except *Marsilea macropus*, which occupies large tracts of flooded land in the interior of Australia. When dried up the spore-cases, which are about the size of wheat-grains, are found in large quantities and used as food by the natives. It came into notice some years ago, in the ill-fated Burke and Wills expedition, under the name of *Nardoo*.

M. quadrifolia is a native of some parts of Europe, but in this country the family is represented by *Pilularia globulifera* and *Isoetes lacustris*, two plants with grass-like leaves, growing at the bottom of shallow pools and lakes.

The Adder's Tongue Family.

(OPHIOGLOSSACEÆ.)

Plants with leafy erect or pendulous fronds growing on the earth or on trees. The spores are contained in valved cases (Fig. 11, *c*), forming simple or branched spikes, rising from the surface of the frond. In this country the family is represented by the common Adder's tongue (*Ophioglossum*

vulgatum) and Moonwort (*Botrychium lunaria*). The former is extensively collected by herb-gatherers, and being mucilaginous is used in the preparation of salves; its ancient reputed virtues, as well as those of the moonwort, are merely imaginary. A tropical species, *Ophioglossum pendulum*, grows on trees, and hangs down like ribands, four to six feet in length; *O. palmatum*, also growing in similar situations, has its leathery fronds divided in lobes like the hand.

Filices (Ferns).

Ferns are plants consisting of stem and leaves, the latter called fronds, which are either simple and entire or variously divided and spirally unfold, being traversed by veins composed of indurated tissue. From different parts of their underside or margin are produced clusters or lines of spore-cases, called *sori*, the cases being membranous, and furnished with a jointed elastic ring (*annulus*), or horny and ringless. The *sori* are either naked or furnished with membranous coverings, called *indusia*. The fronds vary in size from one inch to large decompound fronds fifteen or more feet in length, some having creeping thread-like stems, while others have tree-like stems, fifty or more feet in height, bearing at the top a crown of leaves.

The Ringless Fern Family.

(Marattiaceæ.)

Spore-cases destitute of a ring, either free or united, forming valved cysts, each opening by a pore or slit (Fig. 11, *c*). These plants have often very large fronds, the different parts of which vary in such a manner as to have led botanists to describe a great number of species. Probably their number does not exceed thirty, most of which are natives of the tropics, one species extending to New Zealand and Norfolk Island.

a
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The stems of *Marattia* and *Angiopteris* are of a mucilaginous mealy nature, and are eaten by the natives of some of the Pacific Islands.

Ferns rank as one of the widest spread families in the vegetable kingdom, being found in greater or less numbers in all climates between the most northern and southern limits of vegetation, and at elevations ranging from the sea level to 14,000 or 15,000 feet within the tropics. Comparatively few species are found in open, thinly wooded places, such districts being often occupied by one of the most gregarious and abundant of all ferns—the common brake (*Pteris aquilina*), which occupies large tracts of the earth's surface. With regard to the number of species in this family, great diversity of opinion exists, much of what has already been written about them having been derived from portions of fronds only, which are so variable that even parts of the same frond have been described as distinct species. In the Species Filicum of Sir William Hooker, nearly 2300 are described; but as new forms are continually being discovered, 2500 may with propriety be given as the approximate number.

THE RINGED FERN FAMILY.

(POLYPODIACEÆ.)

Fronds bearing spore cases (*sporangia*) on their under surface or margin, or on contracted (*rachiform*) fronds. Spore cases, membranous, generally pedicellate, and furnished with a vertical or horizontal jointed ring (*annulus*).

This family comprehends the greater number of known ferns, and presents two very distinct modes of growth. The first, *Eremobrya*, having the fronds jointed (articulated) with the axis of growth (*rhizome*); the second, *Desmobrya*, in which the fronds are adherent and continuous with the axis, forming a sarmentum or erect caudex.

The following are the sectional divisions of this family:—

SUB-FAMILY I.—POLYPODEÆ.

Spore cases membranous, furnished with a vertical ring.

This comprehends the majority of ferns, including the whole of the British species, with the exception of about four.

SUB-FAMILY II.—GLEICHENEÆ.

Spore cases furnished with a horizontal ring. Sori round, dorsal.

This is principally represented by the genus *Gleichenia*, natives within or near the tropics, their fronds being continuous and repeatedly forked. *Matonia pectinata* is one of the most rare and beautiful of all ferns, and is found only on Mount Ophir, in the peninsula of Malacca. Its fronds are borne on slender foot-stalks (stipes) from five to six feet high, averaging two feet or more in width, divided into pectinate pinnæ, much resembling a fan-leaved palm.

SUB-FAMILY III.—HYMENOPHYLLEÆ.

Spore cases furnished with a horizontal ring produced in marginal cysts on membranous fronds.

This contains the *Filmy Ferns*, represented by numerous species of *Hymenophyllum* and *Trichomanes*, of which three species are natives of this country, but rare and local.

SUB-FAMILY IV.—OSMUNDACEÆ.

Spore cases produced on spikes or panicles, rarely dorsal, furnished with an apical, horizontal ring, which is sometimes rudimentary only.

This section is represented in this country by *Osmunda regalis*, and in tropical America by the genera *Anemia* and *Schizæa*.

Although the species of this family are both numerous and variable, they possess but few qualities of much importance in the arts or domestic economy. Many are used medicinally in their respective countries, some being more or

less astringent, emetic, or purgative. The following are a few of the most important. *Adiantum capillus-veneris* is widely dispersed through both tropical and temperate countries, varying slightly in form in different localities. In Italy, a syrup called Capillaire is made from it, and used medicinally for coughs, &c. *Lastrea Filix-mas*, one of the most common British species, has long had great medical reputation for its astringent and vermifuge qualities.

Common Bracken (*Pteris aquilina*). Its thick, creeping underground stems are of some utility as food; but it is only in Australasia that it is much used by the natives. Its ashes contain a large amount of alkali.

Cyathea medullaris is one of the noblest of tree ferns, in some of the Pacific isles and on the east coast of Australia and New Zealand, where it forms an important article of food to the natives. The part eaten is the pulpy substance in the centre of the stem. This is of a starchy, mucilaginous nature, and to obtain it the trees have to be destroyed.

Balantium culcita. The beautiful, soft, silky hairs of this plant are used by the natives of Madeira and the Azores for stuffing cushions.

Cibotium Menziesii, and probably one or two other species, natives of the Sandwich Islands, produce the substance called *Pulu*, which is the woolly covering of their stems. Some years ago this substance was collected in large quantities, and shiploads of it sent to Australia and California. The hairs of *Cibotium Barometz* and other Eastern species are used as styptics. *C. Barometz* is a native of China and other parts of eastern Asia. Its woolly stems lying on the ground resemble some wool-clad animal, which gave rise to the fabulous story of "*Barometz*," or "*Tartarian Lamb*," being described as "an animal fixed to one spot, and eating the grass around it."

Ferns have of late years become great favourites with cultivators. The number of exotic species already introduced and cultivated in this country amount to about 1000. Forty-six species are considered to be natives of Britain, but they are also found in other countries.

With regard to the fertilization of Ferns and Cryptogams in general little can here be said. The microscope has revealed the presence of organs that apparently perform the same functions that stamens and pistils do in Phænogams.

The Fern spore vegetates in the form of a simple, oblong cell, from which other cells are successively produced, ultimately forming a thin green membrane, called the *prothallium*, which lies nearly flat, and attaches itself by the aid of fine spongioles to the surface. When of full size it is round or oblong, varying from a quarter to half an inch in diameter, and having the appearance of a small foliaceous lichen. In the progress of its growth peculiar cells are formed on its under surface of two kinds—one called *Antheridia*, the other *Archegonia;* the first containing round cells called sperm cells, which contain minute worm-like bodies, that issue from the cells when arrived at maturity. The cells of the *Archegonia* differ considerably in their structure from the *Antheridia;* they contain an embryonal sac, which at a certain period protrudes from the cell, and with which the moving spermatozoids are said to come in contact, and thus produce fertilization. Soon after this the embryo sac is changed, a bud is formed, and ultimately a young fern plant is gradually developed; in time the prothallium dies.

DIVISION II.—PHÆNOGAMS.

FLOWERING plants with vascular structure complete. Organs of reproduction (stamens and pistils) evident, generating an embryo within an ovule, which becomes a seed, the embryo being furnished with one, two, or rarely more cotyledons.

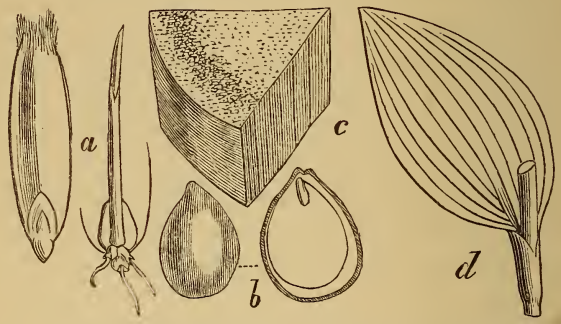
This grand division includes all plants furnished with stamens and pistils, which with their vascular structure distinguishes them from Cryptogams. The first, or primary divisions, are characterized by their cotyledons, the mode by which their stems increase in diameter, and in the leaves having free, or netted veins, which with few exceptions to these characters, admits of classifying the whole of the flowering plants under Exogens and Endogens.

The principal exceptions to parts of the above characters are the Yam and Sarsaparilla families, agreeing with Endogens in their monocotyledonous embryo, and with Exogens in their stems having a woody axis, true bark, and net-veined leaves. This difference induced Dr. Lindley to consider them as a distinct class, which he called Dictyogens, but this view is not adopted by al botanists. In Exogens they may be viewed as related to the Moon-seed family, and in Endogens to the Asparagus section of the Lily family, where I have placed them in this work.

CLASS III.—ENDOGENS.

Embryo with one cotyledon. Leaves with simple or forked, free not *netted veins. Stems homogeneous, without true bark.*

FIG. 12.



a, b. Germination of Seed; *c.* Section of Palm Stem; *d.* Leaf showing the parallel free veins.

This class contains the Grass, Rush, Lily, Palm, and Pine-apple families, and is readily known by the leaves having parallel, or divergent veins, as well as by the one seed lobe, which characters distinguish them from Exogens (fig. 12, *a, b, c, d*).

With the exception of the Arum family, the normal number of the development of parts is 3, or its multiple, thus the floral $\frac{3}{3}$, separate or more or less united stamens 3—6—9. With the exception of the Grass alliance the ovary is 3-celled, and its being inferior or superior presents the most important divisional characters.

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d
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SECTION I. OVARY SUPERIOR.

The Grass Family.

(*Gramineæ.*)

Annual, or perennial plants, with narrow leaves known as grass, generally producing hollow flowering stems (*culm*), which are jointed, with sheathing, alternate leaves, being either annual as the Hay-grass, or perennial as the Bamboo. Flowers terminal, in spikes, racemes, or on simple or compound panicles; each flower instead of having a true calyx and corolla, being composed of three kinds of chaff-like scales (glumes or paleæ) anterior to each other, stamens 3—6, rarely 2. Filaments and anthers slender. Pistils 2, feathery, seated on a single ovary, which becomes the seed or corn grain. Flowers sometimes unisexual.

The grasses are the most important of all plants to man. Naturally they occupy vast plains and mountain slopes, producing corn for his bread, and food for his flocks and herds. Nearly 4000 species are enumerated, of which about 130 are natives of Britain. They vary considerably in size, *Aira præcox* and *Knappia agrostidea* not exceeding two inches in height, while the graceful Bamboo attains a height of 100 feet.

Grasses contain sugar and silica in their stems, and starch in the albumen of their seeds; sugar being most abundant in the Sugar-cane, and the silica becoming obvious in the burning of hay or corn stacks, when it is found vitrified in masses. But few species possess poisonous qualities.

Wheat (*Triticum vulgare*). A well known annual grass producing the staff of life to millions of people in temperate regions. The various uses of wheaten flour are too numerous and well known to require description. Newly ground flour undergoes the process of dressing, by which the skin (bran) embryo, and other rough particles (pollard), of the grain are separated from the pure flour. "Semolina or Semola" is the hard particles of Italian flour, and is imported into this country. "Macaroni" and "Vermicelli" form a great part

of the food of the lower classes, in Italy, and are made from a small-grained wheat, grown in that country for the purpose.

Straw is extensively used for making hats, bonnets, fancy baskets, and other articles of domestic use or ornament in this country, constituting the chief trade of Dunstable and St. Albans. Recent experiments and observations tend to show that wheat originated from the repeated cultivation of a harsh, decumbent grass, *Ægilops ovata*, native of the south of Europe. If such is really the case, the change must have taken place in early times, for we read that "Reuben went in the days of the wheat harvest," which shows that wheat was cultivated 3600 years ago. Wheat grains, in conjunction with flint implements, have been found in the deposited remains of the recently discovered lake villages of Switzerland; which fact proves that it was grown in Europe in prehistoric times. Since the extension of navigation wheat has become an important agent in the spread of civilization throughout the world. It is the weapon in the hands of the white man that enables him to gain possession of the black man's forest and hunting grounds, which become corn-fields, the aboriginal races gradually retiring and becoming extinct. In this country wheat is extensively cultivated, but the produce is far below the quantity required, and great importations come from the ports of the Baltic, Black Sea, North America, and within the last few years from the Australian colonies. Several varieties are cultivated.

Spelt (*Triticum spelta*). A hard-grained wheat similar to barley, and is supposed to be the "rye" cultivated in the time of Moses. *T. compositum*, has a compound head formed of several ears, and as it grows in Egypt agrees with the seven ears of corn that came up on one stalk as seen by Pharaoh in his dream.*

Barley (*Hordeum distichum*, two-rowed, and *H. hexastichum*, six-rowed barley). Annual grass is extensively culti-

* Genesis, chap. xli. ver. 5.

vated in all temperate countries from the earliest times, as we read that "the flax and the barley was smitten."* Barley is also used for making bread. When the thin covering of the grain is removed, leaving the soft part or the albumen entire, it forms the well known Scotch and pearl barley. It also plays a most important part in the social habits of the people of this country, being converted into "malt," from which the beverages ale and porter are made, and by distillation, gin and whisky.

Oat (*Avena sativa*). There are many varieties of this plant, and experience has shown that all have originated from the wild oat (*A. fatua*). Oats are extensively cultivated throughout the whole of Northern Europe, oatmeal forming a substantial food for the people in Scotland; but the cultivation of wheat has in many parts superseded it. "Emden groats" are the grains in a prepared state.

Rye (*Secale cereale*). This is said to grow wild in the eastern parts of Europe, especially in the Crimea. It has been long cultivated in Germany and more northern countries, where it is extensively used for food. In this country it is but little grown.

Rye is subject to a disease called "ergot" (see p. 103), and is then called spurred rye.

Maize or Indian Corn (*Zea Mays*). This belongs to the class Monœcia of Linnæus, having stamens and pistils in separate flowers on the same plant. It is a strong-growing annual grass of a cane-like appearance, attaining the height of 4—6 feet, and is terminated by thick cylindrical heads, bearing corn grains, the whole being enclosed by a sheath or spathe, and are called "cobs." Previous to the discovery of America Indian corn was cultivated throughout that continent in places favourable to its growth, and is now grown in all warm countries, forming in many a staple article of trade. Large quantities are imported to this country, principally from the United States. When young the heads are boiled

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* Exodus, chap. ix. ver. 31.

or roasted, and eaten as a vegetable : a fine flour prepared from it and called Maizena, has lately come into use. In favourable summers it grows freely and ripens its "cobs" in this country.

Rice (*Oryza sativa*). Rice is the staple food of millions of people in India, China, and other Eastern countries. In India it is also used to feed the domesticated elephants. It is cultivated on low lying level lands, as at some periods of its growth it requires to be flooded with water, for which purpose canals traverse whole districts of what are called "paddy fields." In some seasons when rain fails, famine is the consequence, as is frequently experienced in India. Rice is extensively used in this country, large quantities being imported from India and other Eastern countries, as also from the United States, from which latter place it comes under the name of "Carolina rice," which is considered of the best quality.

Canadian Rice (*Zizania aquatica*). A native of North America, growing in shallow waters. The blades float, and the panicles of flowers rise above the surface and produce a grain similar to, but longer and narrower than oats. It forms a great part of the food of some of the Indian tribes.

Manna Grass (*Poa fluitans*). A native of this country, and common throughout Europe and Australia. It grows in water. Its seeds are sweet, and the substance called "manna croup" is made from them in Poland and Germany.

Guinea Corn, or Millet (*Sorghum vulgare*). This is extensively cultivated in tropical and subtropical countries, and was known in Palestine in the time of Ezekiel.* It is made into a kind of bread, and in India is known by the name "dhourra." It has some resemblance to "Indian corn," but is not so strong, producing its small grains in long cylindrical heads. Carpet brooms and some brushes are made from the stiff seed spikes.

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* Ch. iv. ver. 9.

Panicum italicum and *P. miliaceum* are commonly grown in Europe as millet.

Sugar (*Saccharum officinarum*). A strong cane-stemmed grass, 10—12 feet high, producing a large feathery plume of flowers. It is a native of the Eastern hemisphere, but like many other plants that have been long under cultivation, the cradle of its birth is not well known. It is found wild, as well as cultivated throughout tropical and subtropical Asia, and the islands of the Indian and Pacific Oceans. It was first known in India, from whence it is said to have been brought to Europe by the Venetians about the middle of the 12th century, and was early cultivated in the islands of the Mediterranean. It was afterwards introduced into Spain and Portugal, and also to the continent of America, becoming firmly established by the middle of the 16th century. It has acted an important part in the social condition of the world, the native Indian race, especially in America, being driven before it, and the curly-haired African negro established in his place, originally under the bonds of slavery. The great supply of sugar imported to this country comes from the West Indies and Brazil, as also from the Mauritius, of which island it forms the staple product. Sugar is the expressed juice of the cane, which by boiling and other processes becomes crystallized, and is called "brown sugar;" after being refined and cast in conical moulds it is loaf or "lump sugar." The uncrystallized portion is called "treacle" or molasses. From the scum and rough portions of the latter rum is obtained by distillation. The sugar-cane is probably the "sweet cane from a far country" spoken of in Jeremiah, chap. vi. ver. 20.

Bamboo (*Bambusa arundinacea*). This is known as the common bamboo of India, but there are other species of the same habit. It is a perennial grass, the stems of which rise from a strong rootstock, first appearing like large heads of asparagus, and growing at a rapid rate. Two shoots in the Palm House at Kew were daily measured, and in 70 days they had attained the height of 36 feet. In Jamaica it is

known to attain the height of 100 feet in little more than five months. The diameter of the cane varies from 3—6 inches, and when about 30 feet high it begins to throw out lateral branches, and produce its true grass leaves. Throughout the warm parts of India it forms vast impregnable thickets or jungle, and there as well as in China it is converted into nearly every article of domestic use, from ornamental trinkets to house building, fences, pipes for conveying water, and various purposes in agriculture. There are several species of bamboo with stems no thicker than the finger, which on account of their smoothness and hard texture are used for various purposes. In the warm parts of tropical America a species is found (*B. guadua*) which is allied to the Indian species.

Blow-pipe (*Arundinaria Schomburgkii*). A hollow reed-like grass, similar in growth to the "bamboo." It is a native of the country bordering on the head waters of the Orinoco and Amazon. It rises to a height of from 50—60 feet, with a diameter of about $1\frac{1}{2}$ inch. For the first 16 feet the stem is quite smooth and without a joint. This part forms the Indian's rifle. The natives use it by simply placing a poisoned arrow in the tube, which is directed towards the object, a blast from the mouth sends the fatal shaft with great rapidity and unerring aim. The poison soon takes effect, and any bird or animal struck by it speedily dies, but the flesh is not rendered unwholesome.

Esparto grass (*Lygeum spartum*). A strong perennial grass, having a rush-like appearance, growing in tufts. It is a native of the Mediterranean shores, particularly those of Spain, Barbary, and Algeria, where it covers vast tracts of sand plains. In Spain it is used in the manufacture of hats, mats, baskets, and the like, and of late years has become of great repute for paper-making. The grass being of a soft nature, is readily brought into a pulpy state fit for the latter purpose, and large quantities are imported to this country.

Lemon grass (*Andropogon Schœnanthus*). A perennial tufted grass, growing wild as well as cultivated in many parts

of India. It yields an essential oil which is used in perfumery, pomatum, &c.

Cuscus, Koosa, or Khus (*Andropogon muricatus*). A grass of great utility in India, its fine fibrous roots being woven into a thin fabric, used to keep the flies, mosquitoes, as well as hot dry winds, and dust out of verandahs; being moistened occasionally, they emit a pleasant perfume. It is also used for perfuming Egyptian baths. *A. calamus-aromaticus*, from which an aromatic oil is obtained, is allied to the preceding. This plant is supposed to be the "sweet calamus" of Scripture.* *A. gryllus*. A strong grass, with stiff, wiry roots, native of the South of Europe. Large quantities of the roots are imported as "*chiendent*," and are used by brushmakers in the manufacture of toilet and other brushes.

Tussack grass (*Dactylis cæspitosa*). A strong tufted species, a native of the Falkland Islands, where it grows in great abundance. It has long, broad leaves, and these together with the fibrous roots are sweet. Cattle are extremely fond of it, but from their eating out the centre to the very root, it will probably soon become extinct. About 25 years ago attempts were made to introduce its cultivation into this country, but the climate was found too dry for it. It has, however, succeeded on the west coast of Scotland, especially in the Island of Lewis.

Hay. In this country hay fields contain several kinds of grass, such as Rye grass (*Lolium perenne* and *L. italicum*), Cat's-tail grass (*Phleum pratense*, *Poa pratense*, *Cynosurus cristatus*), and the sweet-scented vernal grass (*Anthoxanthum odoratum*), which gives the fine sweet scent to the hay. Several other grasses are also common to hay fields and pastures.

Canary seed (*Phalaris canariensis*). An annual, growing to the height of 2—2⅓ feet, having its flowers in heads similar to hops. It grows freely in this country, and produces the

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* Exodus, chap. xxx. ver. 23.

well known canary seed given to cage birds. In nature some grasses act an important part in keeping back the inroads of the sea, even gaining possession of large tracts of the shore, as may be seen on many parts of the low coast of England and Scotland, the chief being mat grass or Marum (*Ammophila arenaria*), Lyme grass (*Elymus arenarius*, and *E. geniculatus*).

Reeds (*Phragmites communis*). Native throughout Europe, and growing abundantly in this country on the banks of the Thames, in some parts forming extensive thickets. The reeds are cut and used for many purposes, thatching, &c.

This, or an allied species, may be considered to be the "*reed*"* or "rush" mentioned in several parts of the Bible, but not the paper reed, or the reed used at the crucifixion.

Donax (*Arundo donax*). A broad-leaved reed, in habit resembling the bamboo, but not exceeding 8—10 feet high. It is a native of the south of Europe, and also grows in Palestine. It is used for many domestic purposes, walking-sticks and measuring rods are made of it, and it is probably the reed on which the "sponge" filled "with vinegar" was placed. (See Hyssop.)

Couch grass (*Triticum repens*). This is a well known pest to gardeners and farmers, soon overrunning gardens and fields, and if not speedily checked it becomes very difficult to eradicate.

Cynodon dactylon. A creeping pointed grass having flowers on fingered spikes. It is a native of this country, but rare. In many countries it occupies large areas and may truly be styled an invader. It covers the Sunderbunds, near Calcutta, and although showing very little above the surface, its roots are thickly matted together, and being sweet are collected daily in large quantities and taken into Calcutta for feeding horses.

Darnel (*Lolium temulentum*). A strong-growing grass, similar to "rye," often becoming a troublesome weed, espe-

* Matthew, chap. xxvii. ver. 48. Mark, chap. xv. ver. 36.

cially in corn fields. If its grains are accidentally ground with the corn they produce serious effects on those who partake of it. This may be considered the only poisonous or deleterious grass native of this country. It is probably the "tares" spoken of in St. Matthew's Gospel, chap. xiii. ver. 25, 26, 27, and 29.

The Sedge Family.

(Cyperaceæ.)

Annual or perennial grass-like plants growing in tufts, generally having harsh, sharp-edged, sheathing leaves, and solid flower-stems without joints. The stems are either cylindrical or angular. Flowers monœcious or dicœcious, generally in spikelets, or catkin-like heads, each flower consisting of scale-like bracts or glumes, as in grasses. Stamens generally 3. Pistils 1. Style bifid or trifid. Fruit a 1-seeded, hard, bony nut, often angular.

This family consists of about 2000 species, found, like grasses, in all parts of the world, even extending to the utmost limits of vegetation in the polar regions. They grow in pools, ditches, and on river banks, commons, waste places, mountain tops, and dry sandy parts of the sea-shore.

They differ from grasses in having no fecula, or sweet principle, and are almost useless as food to either man or cattle. Some few have a medical reputation in their native countries, but none are of any special importance.

In this country the family is represented by numerous species of the genus *Carex*, commonly known as sedges.

Several species of *Cyperus* have tuberous roots, and are cultivated in India and China for food. *C. esculentus* is cultivated in the south of Europe.

Cyperus textilis and *C. corymbosus* are extensively employed in India for making ropes and mats for covering floors, and for other domestic purposes.

Bulrush (*Scirpus lacustris*) grows abundantly in ditches and watery places in this and other countries of Europe and in Western Asia. It is extensively used for making mats and ropes, but more especially for chair bottoms and hassocks.

Papyrus (*Papyrus antiquorum*). Supposed to be the "Bullrush" of the Nile, of which the "ark" of the child Moses, as also the vessels spoken of in Isaiah* were made, but it appears to be of more ancient date, it being the plant from which the papyri, or paper, was made, and upon which the records found in the Egyptian tombs were written.

It grows in the Lake of Galilee and other parts of Syria, and is "the paper reed by the brooks."† It has strong roots or rather rhizomes, which grow in the mud and throw up smooth, triangular stems 6 to 10 feet high, and about an inch in diameter. The interior of these stems consists of white pith, and they are terminated by a round head of slender grass-like panicles of flowers. Good examples may be seen in the hot-houses at Kew.

Cotton grass (*Eriophorum angustifolium*), and other species, are common in wet places in this country. When perfect its seeds are furnished with cotton-like down, which is sometimes used for stuffing cushions. *Carex arenaria* grows in tufts forming hillocks, and binds the moving sands of the seashore.

Nearly allied to Cyperaceæ is a small family called *Xyridaceæ*, the chief distinctive character of which is that their floral envelopes are more fully developed and coloured, growing in terminal, scaly heads. Seventy species are enumerated all widely distributed, being chiefly natives of warm regions. They have no special uses.

The Cat's-tail or Bur Reed Family.

(Typhaceæ.)

Aquatic, marshy, perennial plants, having reed-like flower stems, and narrow or broad sword-shaped leaves. Flowers monœcious, produced in dense cylindrical heads consisting of numerous florets each formed of hair or scale-like glumes. Fruit a small nut.

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* Isaiah, chap. xviii. ver. 2. † Isaiah, chap. xix. ver. 7.

About twelve species compose this Order. They are widely dispersed, and are represented in this country by the "Reed Mace" (*Typha latifolia*), which is also widely distributed throughout Europe, North Asia, S. Africa, and N. America. It was at one time abundant in the marshes around London, and not many years ago the last remnant was seen in a bog between Shepherd's Bush and Kensington. The locality is now occupied by railways and fine mansions.

They have no special uses.

The Restiad Family.

(RESTIACEÆ.)

Plants with slender reed-like stems, often two-edged, and sheathed, from which tufts of little branchlets are produced, having in some cases grass-like leaves—while in others these are absent, or not developed. Flowers monœcious, or diœcious in spikes, or heads. Stamens 2—3, included in glumes or scales, as in grasses. This is a curious family of plants in habit, having an intermediate position between grasses, sedges, and rushes. Above 150 species are enumerated, natives chiefly of South Africa, Australia, and South America. They have no special uses except in their wiry stems being made into baskets.

The Pipe-wort Family.

(ERIOCAULACEÆ.)

Perennial plants growing in water, having grassy, sheathing, spongy leaves, and globular heads of minute flowers, produced on long footstalks. Two hundred species are enumerated, chiefly natives of the tropics and Australia, several of North America, and represented in this country by *Eriocaulon septangulare*, a native of the lakes in the Isle of Skye and Connemara. They possess no special qualities, but are botanically interesting.

THE RUSH AND POND-WEED ALLIANCE.

The Rush Family.

(JUNCACEÆ.)

Stemless herbaceous plants with leaves and flower-stalks rising from a creeping rhizome-like root, or with a decumbent or erect palm-like stem. Leaves flat (generally channelled) cylindrical, or triquetrous. Flowers in spikes, panicles, or compound heads. Sepals and petals glumaceous, sometimes coloured yellow or blue. Fruit usually a dry 3-valved capsule with nut-like seeds.

This family consists of about 200 species, widely distributed over both hemispheres and widely diverse as to habit. In the northern hemisphere they are represented by different species of Rush (*Juncus*), some of which extend to the Arctic regions. About 20 species are natives of Britain, the most abundant being *J. effusus*, *J. conglomeratus*, and *J. acutus*, which grow in ditches and marshy places.

They are extensively used for making chair bottoms, hassocks, mats, baskets, and the pith is used as "wicks" for "rushlights," or night-candles. They are but little used either for food or medicinally.

Asphodel (*Narthecium ossifragum*). A beautiful, perennial native plant, with leaves like a leek, and pretty yellow flowers. It was supposed to cause disease in sheep, and hence received the specific name "ossifragum," which means "bone breaking."

Palmet (*Prionium palmita*). A remarkable plant, native of S. Africa, growing in deep waters; it has serrated leaves 2—3 feet long and about 1 inch broad, which by their successive development and sheathing bases form a stem which varies in length according to its age, from 6—12 feet, and 3 inches in diameter. It generally lies slanting in the water, with its crown of leaves rising above the surface, and when numerous the water has the appearance of a field of pineapple plants. The whole stem consists of a fine fibre,

which is capable of being converted into paper, and it has been used for brushes.

Grass tree (*Kingia australis*). A remarkable plant, native of the south and south-west of Australia, growing in dry places. It has a trunk a foot in diameter, composed of the bases of the hard, three-sided, grass-like leaves. The leaves are successively produced from the top of the stem, and curve downwards. The older ones fall away, or more often are burnt away by the grass-fires of the natives, leaving the charred and blackened stems which in old plants attain the height of 6—8 feet.

The flowers are borne in dense round heads, on a footstalk about a foot long, several rising from the crown of leaves.

It possesses no special economic uses.

The family is represented in New Zealand by the genus *Astelia*, tufted plants with pineapple-like leaves.

THE WATER PLANTAIN OR POND-WEED ALLIANCE.

This alliance consists of about 150 species of widely distributed soft grass, or broad leaved herbs; generally growing in water or wet places. But few possess economic properties or uses.

The Flowering Rush Family.

(Butomaceæ.)

This, with the two following families, are considered by some botanists as one only. They are marsh, or floating plants, found in the tropical and temperate zones. The present family consists of about 6 species, and is represented in this country by the Flowering Rush (*Butomus umbellatus.*)

Hydrocleis Humboldtii. A native of tropical America, having oval, heart-shaped leaves, which float on the surface of the water in which it grows. It produces large, showy

yellow flowers singly on a long footstalk. It is a well known plant in the hot-houses of this country, and has been known to flourish in the open air when planted in the waste tepid water from manufactories. When seen in quantity its numerous golden flowers have a beautiful effect.

The Water Plantain Family.

(ALISMACEÆ.)

The "Water plantain" (*Alisma plantago*) is common in ponds and ditches in this country, as is also the "Water Arrow" (*Sagittaria sagittifolia*). It is not so common as the last. Its leaves resemble a broad arrow, whence its name is derived.

The Pond-Weed Family.

(JUNCAGINACEÆ.)

Is represented in this country by *Triglochin palustre*, and several species of *Potamogeton*, commonly known as "pond weeds." *Aponogeton distachyon* is a native of the Cape of Good Hope. It has oblong, floating leaves, and a forked spike of pretty white flowers. It will thrive in the open air in this country. Allied to this plant in general appearance is the "Lattice Leaf" (*Ouvirandra fenestralis*), a native of shallow waters in the Island of Madagascar. Its leaves have long footstalks, which grow from a rhizome, and vary from 12 to 18 inches in length, and from 2 to 6 inches in breadth. They consist of nerves only, which form a skeleton leaf, the openings being square like lattice-work. It produces a forked spike of flowers similar to *Aponogeton*. This plant was introduced in 1855, and was successfully cultivated at Kew, producing leaves 3 feet in length.

The Frog-bit Family.

(HYDROCHARIDACEÆ).

Plants growing at the bottom, or floating on the surface of water. Leaves heart-shaped, oval, or long like grass, sometimes sword-shaped. Flowers generally inconspicuous. In alliance with this are the families "*Naidaceæ*," and "*Zosteraceæ*," water plants of nearly the same habit as the preceding. These three families consist of about 50 species, widely distributed throughout temperate and tropical regions in both hemispheres, and growing either in fresh water or at the mouth of tidal rivers.

Frog-bit (*Hydrocharis morsus-ranæ*). A native of this country, growing in pools or shallow ditches. It has heart-shaped leaves produced on floating stems, and its white fibrous roots show the circulation of the sap when viewed through the microscope. This phenomenon may also be observed in the leaves of *Vallisneria spiralis*, a native of the south of Europe (see page 68). This plant grows at the bottom of the water, throwing up long tape-like leaves; a portion of their upper extremity generally floats on the surface. It is dicœcious, the male flowers being produced close to the base of the plant; these when about to expand become detached, and rise to the surface, where they float. The female flowers are borne on long thread-like peduncles, and after they become fertilized by the pollen from the male flowers, the slender stem coils spirally, drawing the young fruit to the bottom, where it becomes further developed.

Water Soldier (*Stratiotes aloides*). A plant resembling a small aloe, floating in water. It is a native of this country, growing in ponds and ditches.

Horned Pond-weed (*Zannichellia palustris*). A floating plant somewhat resembling *Potamogeton*, found in ponds in this country.

Choke Pond-weed (*Anacharis Alsinastrum*). A plant

with leaves like chickweed, arranged three in a whorl, on long, slender, floating stems, which are densely matted together. It is a native of N. America, and about 20 years ago made its appearance in this country, spreading so rapidly that it was feared it would choke up the canals and so prevent navigation. It, however, forms such dense masses that it ultimately becomes exhausted and dies out.

Grass-wrack (*Zostera marina*). A plant with long, narrow, tape-like leaves, 3—4 feet in length. It is a native of this country, being generally found in the estuaries of tidal rivers. When dried it is used for packing, stuffing beds, cushions, &c., and is known by the name of *Alva marina*.

The Duck-Weed Family.

(LEMNACEÆ.)

Small stemless plants, loosely floating on the surface of ponds and stagnant pools in this country. They consist of simple or lobed leaves, and bear small inconspicuous flowers. There are about 20 species, widely distributed in Jamaica and other tropical countries. *Pistia stratiotes* is a singular plant with bright green wedge-shaped leaves, growing in a rosulate manner. It is said to putrify the water, causing miasma. Its curious mode of floating and propagating may be seen in the aquariums at Kew.

THE ARUM, SCREW PINE, AND PALM ALLIANCES.

The Arum Family.

(AROIDEÆ.)

Palmids, phyllacorms, epiphytal ampelids, or rhizocorm herbs, generally of a soft texture, destitute of pubescence. Leaves with sheathing petioles; entire, digitate, or variously lobed, either membranous or leathery, and with netted veins. Inflorescence enclosed in a spathe, consisting of a compact fleshy spike (*spadix*), of small sessile

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flowers, either with or without floral envelopes, bisexual or unisexual on different parts of the spadix. Fruit a succulent berry, distinct or forming a fleshy compound fruit.

About 200 species are known of this family, the herbaceous section being natives of the northern hemisphere, but the greater number are tropical, with palmid stems 6 to 12 feet high; or ampelids 100, or even more feet in length. They differ from most other endogenous plants, the parts of their flowers being arranged in fours, and their leaves being net veined, and sometimes perforated with circular or oblong holes. They generally possess poisonous properties.

Wake-robin (*Arum maculatum*). A well known native of this country, growing in the open parts of woods and waste places. It is known by the peasantry as "lords and ladies" or "cuckoo-pint." Its corm roots are collected in the Island of Portland, and made into sago or "salep," its poisonous properties becoming dissipated by boiling.

Taro (*Colocasia esculenta*, *C. antiquorum*, and *C. macrorhiza*). These have large heart-shaped leaves borne on long footstalks, which rise from a short, fleshy, farinaceous corm. Numerous varieties are cultivated throughout all tropical countries. The corms furnish an important article of food to the inhabitants of tropical India, the islands of the Pacific, and also in the West Indies, where they are called "eddoes" and "scratch-coco." Taro is the general name for them elsewhere.

Indian kale (*Caladium sagittifolium*, *C. nymphæfolium*, and *Arum divaricatum*). These are in habit similar to the preceding, their leaves being used as a vegetable in the Feejee and Sandwich Islands.

Amorphophallus campanulatus. This remarkable plant is a native of India and many of the Pacific islands, producing but one large leaf, borne on a long footstalk 5 or 6

feet in height, and being divided into spreading segments. The flowers are borne near the ground, and are enveloped in a dark brown spathe, and have a very offensive odour. This and other allied species furnish a considerable quantity of nutritious food to the natives in India.

Godwinia gigas, a native of Nicaragua, has recently been introduced to this country. It has a rhizocorm larger than a man's head, from which rises a single leaf, which with its petiole is 13 feet in height. Its flower stem being 4 feet high, bearing a spathe 2 feet in length, of a dark brown colour, and very offensive odour. In the latter respect, it does not much surpass *Arum Dracunculus*, or *Dracunculus vulgare*, a native of the south of Europe, and common in gardens.

Monstera deliciosa. A native of Mexico, and an epiphytal climber; its stems are about an inch in diameter, extending to a great length, and furnished with large cordate lobed leaves perforated with holes. The fruit is about the size of a small pineapple, consisting of pulpy fruits of a pink colour and most delicious flavour. It grows and fruits freely in the hot-houses of this country.

Dumb-cane (*Dieffenbachia seguina*). A native of the West Indies, having a fleshy cane-like stem $1\frac{1}{2}$ inch in diameter, and from 4—6 feet high. Its leaves are oblong elliptical. It is highly acrid and poisonous. If a portion be chewed in the mouth it causes the tongue to swell, and loss of speech for some time; hence the name "Dumb-cane." *Alocasia distillatoria*, a large-leaved species, has the same effect.

Trumpet Lily or Lily of the Nile (*Richardia æthiopica*, better known as *Calla æthiopica*), is a native of eastern Africa, and grows in wet places from Egypt to the Cape of Good Hope. It is recorded as having been introduced to this country 130 years ago. It grows freely in the greenhouse, and its pretty white flowers (spathes) have made it a favourite ornamental plant in rooms, &c.

Within the last few years many species of Alocasia with leaves of a metallic lustre, and Caladiums with parti-coloured,

and even golden-coloured foliage have been introduced, and are esteemed favourite hot-house plants.

The Taccad Family.

(TACCACEÆ.)

A small family of plants which somewhat resemble Aroids, but technically differ in their flowers and fruit. They are generally natives of warm regions. *Attaccia cristata*, a native of India, has fibrous roots, entire leaves, and a singular spathaceous inflorescence borne on a stem a foot high. *Tacca pinnatifida* and other allied species consist of fleshy rhizocorms from which rise large, erect, digitate, or many-parted leaves. They are extensively cultivated in the Malayan and Pacific Islands for their fleshy corms, which contain a farinaceous meal like sago, and forms an important article of food. *T. pinnatifida* is known in the Sandwich Isles by the name of "Pi."

The Screw-pine Family.

(PANDANACEÆ.)

Palmids, generally with fibrous, stiff-branched stems, and aërial roots; or phyllacorms, some epiphytal ampelids. Leaves, grass or sword-like, or elliptical, rarely palmate, entire or with serrated margins. Flowers inconspicuous, monœcious, or dicœcious. Ovaries (fruits) compactly united in globose, conical, or cylindrical heads.

A singular family of plants, consisting of about 80 species, natives of India and the islands of the Indian and Pacific Oceans.

They possess no special properties.

Screw-pine (*Pandanus odoratissimus*). This and other allied species generally grow near the sea in the above-

mentioned habitats. They abound in the Mauritius, and attain the height of 20—30 feet, and are known by the name "bacona." Their stout aërial roots give to their palm-like stems the appearance of being supported on props, and at a distance they look like a candelabrum. This last remark applies more particularly to *P. candelabrum*, a native of west tropical Africa.

Their leaves are 4—6 or more feet in length, and are used for making mats, baskets, and the like.

The thick aërial roots consist of tough, spongy fibre, this is beaten out and is used as brushes. It is also used as a substitute for cork. The head of fruit is sometimes as large as a man's head, but contains very little pulpy or eatable matter. The seeds are embedded in a hard woody substance, and are difficult to extract. The screw-pine is common in the hot-houses of this country.

Freycinetia Banksii, a native of New Zealand, is a sarmentose epiphyte, having stiff, narrow, spiny leaves about 2 feet long, produced in fascicles, and presenting the appearance of a broad-leaved grass, growing in tufts on trees.

Cyclanthus funifera is a similar species, native of tropical America. The older parts of its stems resemble ropes.

Carludovica palmata. A native of Panama, Ecuador, and other parts of Central America. It is a stemless species, with incised, fan-shaped leaves, on petioles or footstalks 8—10 feet long. The celebrated Panama hats and cigar cases are made of the leaves, and form a considerable article of trade in hot climates.

The Palm Family.

(PALMACEÆ.)

Palmids, or ampelids, with hard stems, the first vary from a few to 100 or even more feet in height; while the latter trail or climb to a great height, generally by the aid of hooked spines. Leaves simple, in the form of and plaited like a fan, or pinnate, rarely simple and plane.

Inflorescence, a simple or compound spadix, contained in a spathe. Flowers small, hermaphrodite, monœcious or dicœcious, consisting of 3 sepals and 3 petals. Stamens 3 to 6, or numerous. Pistil simple, seated on a 3-celled ovary, generally by abortion 1-seeded. Fruit a hard nut, covered with a fleshy, fibrous, or scaly rind.

With the exception of grasses, few plants are of more importance to man than palms, more especially with reference to the inhabitants of the torrid zone and contiguous regions, being rarely found beyond 40° N. and 35° S. lat. About 1000 species are enumerated. They abound in tropical America, Africa, India, and other countries. Some species are very gregarious. Palms have been called the "princes of the vegetable kingdom," and although but few were known, and those but imperfectly, in the time of Linnæus, yet that great naturalist fancied that the country of palm trees was the first abode of our race, and that man was naturally palmivorous. Be this as it may, their economic uses are manifold.

The aspect of palm trees being very different from the trees of Europe led to their being early sought after as objects of curiosity, and in 1768 five species are recorded as growing at Kew. Fifty years later, their number had increased to twenty-two, and although not growing under very favourable circumstances, several had attained a size to merit their being spoken of as the "Great Palms of Kew." Thirty years later, they had the chance of becoming really great, for in 1848 they were placed in the noble "Palm-house" specially erected for their reception. Lofty and spacious palm-houses have also been erected in the Edinburgh and Dublin botanic gardens, thus showing that palms are much admired in this country.

Although such is the case, they are nevertheless, with the exception of the climbing species, of slow growth. For many years they are stemless, their leaves being successively developed from a surface or underground enlarging axis, which in some species progresses like a rhizome to a foot or more in length. It continues to increase in size till it attains the normal diameter of the forthcoming stem. While this is being accomplished the leaves acquire a succulent development, ultimately becoming spirally ascending. The axis then progresses upwards, and in time becomes a palm tree stem, differing in girth and rate of growth according to kind.

From more than forty years' observation and other data, I feel warranted in saying that a period of from thirty to fifty years or more elapses before the stems of many palms commence their upward growth, this period having been passed in what may be called their infancy, or age of preparation.

*Fan-leaved Palms.

Palmyra Palm (*Borassus flabelliformis*). A native of Ceylon, India, and generally throughout Central Africa. It has large fan-shaped leaves, and a cylindrical stem rising to the height of 50 to 100 feet. Nearly 10,000 different uses are ascribed to it by the natives. It is one of the wine or "toddy" yielding palms of India, and jaggary sugar is obtained from it in large quantities. The fruit is in bunches, each fruit being about 3 inches in diameter, and its pulpy covering is made into a kind of jelly. The young sprouts of the nuts are brought to the markets, and used in the same manner as asparagus.

Talipot Palm (*Corypha umbraculifera*). This noble palm is a native of Ceylon, and attains a height equal to the last. Its large fan-shaped leaves are borne on prickly footstalks, and like those of the "Palmyra Palm," are carried over people

Pl. 6.

of rank. They are also made into fans, Hindoo books, and other useful articles.

Corypha Taliera is similar to the last, and is used for the same purposes, but it does not grow so tall. It is common throughout India.

Licuala acutifida, and *L. peltata*. Small fan palms not exceeding 6—8 feet in height. They are natives of Pulo-Penang. Their stems are imported to this country in a rough state under the name of "Penang Lawyers," and after they are made smooth and polished, are used for walking-sticks.

Double Cocoa-nut (*Lodoicea sechellarum*). This may be considered the largest and most remarkable of palms. It is a native of a small group of islands in the Indian Ocean called the Seychelles. It is said to attain the height of 100 feet, its stem being $1\frac{1}{2}$ to 2 feet in diameter, bearing at its summit a crown of fan-shaped leaves. It is remarkable for growing in a socket of a hard, woody texture, perforated with holes made by the roots. This curious appendage derives its origin from the cotyledon, which in this palm attains the extraordinary length of 2 feet, growing downwards like a root, having the germ (plumule) seated in its thickened end. When perfect the thick end opens on one side like a sheath, out of which rise the first and succeeding leaves of the plant, roots also being produced, which make their exit by piercing the end of the sheath. In time the nutriment of the nut becomes exhausted; and the part of the cotyledon between it and the young plant withers. The latter, however, retains its placentide vital connexion with the sheath end of the cotyledon, which is henceforth nourished by the plant, and increasing in size with the growth of the plant, which thus continues seated in the cradle of its birth through life.

The fruit is a large, oblong nut covered with a thin rind. After the removal of the outer envelope, or rind, the fruit has the appearance of two oblong nuts, firmly united together, and often weighs 30 to 40 lbs. They are borne in bunches 9 or 10 in number, so that a whole bunch will often weigh

400 lbs. It takes ten years to ripen its fruit, the albumen of which is similar to that of the common cocoa-nut (*Cocos nucifera*), but is too hard and horny to serve as food. The shell is converted into many useful articles by the natives, but the most important part is the leaves, which are made into hats, baskets, and the like. The demand has of late years become so great that in order to obtain the leaves the trees are cut down, and as no care is taken to form new plantations, it is feared this palm will eventually become extinct. In 1864 the leading botanists in this country petitioned the Government for its protection. By more recent information, however, it appears that on one island alone there are many thousands of trees.

Before its habitat was discovered the nuts were found floating on the sea near the coast of the Maldive Islands, which led to the supposition that they grew in the sea, and they were called "Coco de Mer" or "Sea Cocoa-Nut," and were considered very valuable as presents, even to kings.

Gingerbread, or Doum Palm (*Hyphæne thebaica*). A native of Upper Egypt, Nubia, Abyssinia, and adjacent countries. Its stem is a foot or more in diameter, and of very slow growth. It continues simple for a number of years but eventually divides into branches, and attains the height of 20 feet, each branch bearing a crown of fan-shaped leaves. The fruit is borne in a large pendulous bunch, 1—200 together, each fruit being about the size of an apple, having the flavour of gingerbread. The fibrous pulp forms part of the food of the poorer classes in Upper Egypt. This species, or one very closely allied, has been found in South Africa. The stems are not always branched, but often remain undivided and cylindrical, or spindle-shaped.

Common Fan Palm (*Chamærops humilis*). This is found in Southern Europe and N. Africa, where it occupies extensive sandy plains and rocky places. When old it is sometimes 20—30 feet high, but it generally grows in a cespitose

manner, having numerous suckers, and then seldom exceeds 3—4 feet in height. The leaves are used for many purposes, and yield a tough fibre resembling horse-hair, and for which it is sometimes substituted.

Palmata Palm (*Chamærops palmata*). This is a small stemmed palm, 10 or more feet high, occupying large tracts on the eastern coasts of the Southern United States. It was used as an emblem in the late American war on the banners of the Confederate States.

Mauritia Palm (*Mauritia flexuosa*). Found near the Rivers Amazon and Orinoco. Its stems are about 2 feet in diameter, surmounted by a tuft of fan-shaped leaves, and sometimes rising to 100 feet in height. It affords many articles of domestic use to a tribe of Indians, who during the periodical inundations of the rivers, suspend their dwellings from the trees. These dwellings consist simply of a floor of mats made from its leaves, on which they place earth and make their fires, "which," as Humboldt says, "present a singular appearance at night."

> "Wide o'er his Isles, the branching Oronoque
> Rolls a brown deluge; and the native drives
> To dwell aloft on life-sufficing trees;
> At once his dome, his robe, his food, and arms."
>
> *Thomson.*

Wax Palm (*Copernicia cerifera*). A native of Brazil; its cylindrical stem rising to the height of about 40 feet, and measuring about a foot in diameter, and studded its entire length with hard, projecting knobs, an inch in length, being the base of the fallen leaf-stalk. The wood is very hard, takes a fine polish, and is used for veneering. The young leaves are coated with a waxy secretion, which is obtained by shaking the leaves. It is imported to this country and used for making candles.

**Wing-leaved Palms.

Cocoa-nut (*Cocos nucifera*). A native of the coasts of tropical Africa, India, Malay, and islands of the Indian and

Pacific Oceans. It is generally cultivated throughout all tropical countries, and requires no special care.

The tree varies in height from 50—100 feet, and has long winged leaves, the so called "nuts" being produced in bunches of 10—20 or more together. They are of a triangular form, about a foot long, consisting of a thick coat of fibre, enclosing a hard shell, which with its contents is known as the "cocoa-nut."

It is commonly said that the uses of the cocoa-nut are as numerous as the days in a year, affording food, drink, domestic utensils, and materials for building and thatching. In some parts of India and other countries, the white albumen of the "nut" forms nearly the entire food of the natives, and the white fluid or "milk," serves them for drink. It also yields wine and sugar. Cocoa nut oil is obtained by pressing the albumen. When fresh it is transparent, and is then used in cookery. Large quantities of it are imported to this country. The thicker portion, called "stearine," being used for making candles, while the clear oil is used for burning in lamps, &c.

Formerly the fibre was used for making "coir" ropes only, but within the last 30 years it has been manufactured into floor matting, brushes, brooms, and is used for stuffing cushions as well as many other purposes. The hard shell is made into cups, and other domestic utensils. The wood is known as "Porcupine wood."

Date Palm (*Phœnix dactylifera*). A native of North Africa and Western Asia, including Syria, and has become naturalized in the south of Europe. It is a palm of the desert, and is first mentioned in Exodus;* when the children of Israel came to Elim and encamped, "there were three score and ten palm trees." Palestine, in the vicinity of Jericho, was also famed for its palm trees, as also the valley of the Dead Sea, and although once abundant in both localities they are now extinct. The date grows to the height

* Chap. xv. ver. 27.

of 40—50 feet, bearing a crown of leaves, each leaf being 15—20 feet long, with a strong footstalk set with stiff spines. The fruit is produced in large bunches containing from 20 to 30 dates. In Northern Africa dates form a large portion of the food of the Arabs and other tribes, as well as the Bedouin Arabs of the wilderness of Sinai, where the trees grow in entangled thickets. They also serve as food for their domestic animals, and are used for many other purposes. This is supposed to be the palm spoken of in St. John's Gospel, "Took branches of palm trees, and went forth to meet him,"* from which it may be inferred that they were carried as emblems of dignity, and certainly nothing could have a more imposing effect than a number of unexpanded date leaves with their curved apices borne in this manner. In this country date leaves are used as emblems of respect to the memory of great men.

Phœnix sylvestris. A common palm throughout India, attaining a considerable height, and has leaves like the last. It is one of the wine or toddy palms. In Old Calabar and other parts of West Africa toddy is procured from *Raphia vinifera* and several other palms not at present well known to botanists.

When fresh, "toddy" is pleasant, but it speedily ferments and becomes intoxicating; when distilled it is called "arrack," which, like other intoxicating beverages, is pernicious and demoralizing when taken in excess. By boiling, a sugar is obtained called "jaggary." There are several methods of obtaining toddy, but chiefly by cutting off the end of the young flower spike (spadix) before it opens, and fastening a vessel to the end into which the sap flows. A model illustrating the mode of climbing the trees, together with implements for collecting the "toddy," are to be seen in the Museum at Kew.

Caryota urens is another wine palm abundant throughout India, growing to the height of 50 or 60 feet, and having a

* Chap. xii. ver. 13.

large head of compound winged leaves. The leaflets are wedge-shaped, with curious torn edges. This plant also yields a kind of sago. Its fruit is about the size of a small plum, having a red rind which is acrid and burning, hence its specific name. A woolly pubescence is produced on the stem, called *Amadou*, which was formerly used as tinder.

Sago (*Sagus lævis* and *S. Rumphii*, by some botanists called *Metroxylon lævis* and *M. Rumphii*), natives of Siam, the Indian Archipelago, and other islands in the Eastern Ocean. They grow in clumps, or are gregarious, generally in wet places, attaining the height of from 30 to 50 feet; the trunk varies from 6 inches to 1 foot in diameter, surmounted by a plumose crown of winged leaves. The sago is obtained by cutting down the tree and then splitting the trunk. The soft white centre or pith is loosened from the hard wood, and thrown into tanks of water, in which it is repeatedly washed and strained until a pure, pulpy paste is obtained. In this state, in order to preserve it, the natives keep it under water, and it forms a large proportion of their food. For exportation it is dried, and granulated through sieves. Sago is also procured from other palms, natives of the Indian and Malayan Archipelago, especially from *Saguerus saccharifer*, which has a stout trunk attaining a height of 40 to 50 feet, bearing large winged leaves. This palm probably produces the largest leaves of any plant, a specimen at Kew having leaves which, together with their sheathing base, measure 40 feet in length.

Betel Nut (*Areca Catechu*). A native of Cochin China, the Malayan peninsula, and islands. It is a slender stemmed, lofty palm, with regular pinnate leaves and long linear leaflets. The fruit is borne on an erect spadix, and is about the size of a hen's egg, covered with a thick fibrous red rind, which envelopes a hard nut. The nut is cut into pieces and rolled up in a leaf of the Betel pepper, and chewed as tobacco is in this country. This is practised by the whole of the Indian and Malayan races; indeed, it is said that many would rather forego their food than the use of the Betel Nut.

Shiploads of nuts are annually conveyed to countries where it is not cultivated.

Cabbage Palm (*Areca oleracea*). A common palm of the West Indies. It has a slender stem, and grows to a great height. This and others of the same nature are called Cabbage Palms, on account of their young unexpanded leaves being used as a vegetable. *Seaforthia elegans* is the Cabbage Palm of New South Wales; it, with the elegant Fan Palm (*Corypha Australis*), Tree Ferns, Cedar (*Cedrela*), Gigantic Nettle, and other remarkable trees of tropical aspect, formed the primeval natural forests of the Illawarra district of New South Wales, and although one hundred years have not passed since first seen by civilized man, they are now fast disappearing; remnants only remaining in places where the plough has not reached.

Peach Palm (*Guilielma speciosa*). A native of Venezuela, where it is called *Perigao*. It is also found near the Orinoco, and grows to the height of 50 to 60 feet, the stem being covered with long sharp spines. It is largely cultivated for its fruit, which constitutes a great part of the food of the natives.

Coquito Nut (*Jubœa spectabilis*). A native of Chili, and is the most southern of American Palms. In habit it is similar to the Date Palm. The fruit is about the size of a hen's egg, consisting of a husk enclosing a nut about as large as a marble. If the leaves are cut, a large quantity of sap of the consistency of treacle flows out, from which sugar is manufactured, forming an article of Chilian trade. The nuts are eaten, and are sometimes imported to this country.

Assai Palm (*Euterpe edulis*). A Brazilian palm found on low grounds, and at the mouths of rivers near the sea, as at Para, where it grows in great abundance. It has a slender stem, about 30 feet high, bearing its fruit in bunches. The fruits are of a bluish colour, about the size of sloes, and have a small amount of pulpy matter between the skin and the nut. They are thrown into water and bruised until the pulp is mixed with the water, which is then strained off. A mixture of sugar and Cassava flour is added to the liquor,

which then forms the food of a large number of the people of Para.

Piassaba (*Attalea funifera* and *Leopoldina piassaba*). Stout growing Brazilian palms, which have a very unsightly appearance on account of their old leaves hanging down, and their stems being covered with loose, shaggy fibre, which is used for making ropes and mats. Shiploads are imported to this country, chiefly for making street and other brooms. The nuts of *A. funifera* (Coquilla nuts) are about 3 inches long, very hard, and are used for making door handles, bell-pulls, &c. In some parts of Central America the stems of the Attaleas are converted into natural drinking fountains, and when wanted for that purpose a tree is cut down, and a deep cavity scooped out on the side of the stem near the top. The base being slightly raised causes the sap to flow towards and collect in the cavity, from which it can easily be obtained by the passers by.

Maximiliana regia. A noble palm of the Amazon, rising to the height of 100 feet, and crowned with winged leaves 30 feet long. The spathe containing the fruit is of a hard, woody texture, 5 or more feet in length, and when open 2 feet wide, much resembling a boat, with a long peak like a bowsprit. These spathes are used for a variety of purposes by the Indians, such as nursing cradles, baskets, and even for water vessels.

Raphia Ruffia. A native of the Mauritius and Madagascar, and is remarkable for its large, pendulous bunches of fruit, which are 12 to 15 feet long, each fruit being about the size of a hen's egg, the shell consisting of closely imbricating scales, the whole bunch weighing from 200 to 300 lbs. This palm is also remarkable for growing in a socket like the "double cocoa-nut."

Palm Oil (*Elœis guineensis*). This palm occupies vast territories in tropical West Africa. It is a low-growing species seldom exceeding 20 feet in height, having a fine plumose crown of pinnate leaves, similar to that of the Date Palm (*Phœnix dactylifera*). It is of great longevity,

and yearly produces bunches of fruit 2 or 3 feet long, and as much in circumference. The fruits are about the size of walnuts, having a red rind, which envelopes a pulpy matter and a hard nut. The fleshy part is separated, and after boiling and skimming, the "palm oil" of commerce is obtained, shiploads of it being imported to this country for the purpose of candle-making; it is also used in the manufacture of soap. The yellow grease used for the carriage wheels on railways is this substance. The nut is also crushed, and yields oil, the refuse being made into "oil-cake" for cattle feeding; in its fresh state it is used by the natives for butter. It is believed that this palm will ultimately prove a powerful agent in changing the political and social condition of the negro race, the kings and chiefs finding it more advantageous to employ their subjects in collecting and preparing the oil, than in selling them as slaves. Several other palms yield oil, as *Attalea Cohune*, a native of Central America.

Most oils contain a principle called the "sweet of oil," which when chemically separated forms the transparent oily substance *glycerine*. In this country it is chiefly obtained from palm oils and Japanese wax; its antiseptic and preservative powers have brought it into use for preserving soft animal and vegetable substances for culinary and many other purposes. It is also used medicinally, and its emollient and slow evaporating nature renders it useful in skin diseases, and also in the preparation of cosmetic perfumes.

Wax Palm (*Ceroxylon andicola*). A native of the mountainous regions of New Granada, where it ascends nearly to the snow line, forming forests which may be compared to the fir forests of more northern latitudes. It is a tall growing palm, bearing a crown of winged leaves 15 or 20 feet long. The whole plant is of a grey colour, its trunk being coated with a resinous wax, which is collected by scraping, and forms an article of commerce amongst the natives. The wax is made into candles, which are presented as offerings to their saints and the Virgin. It is but little known in this country.

Ivory Nut (*Phytelephas macrocarpa*). A native of New Granada, Darien, and other parts of Central America. The stem is generally 6 to 8 inches in diameter, suberect, decumbent, or even creeping on the ground. The leaves are pinnate, 18—20 feet long, having narrow segments like the date palm. The flowers are diœcious, and are enclosed in a spathe—the head of fruit when perfect being globular, about the size of a man's head, and containing on an average about 40 nuts; the whole head weighing upwards of 30 lbs. Each nut is about the size of a green walnut, but not quite round; when young they are coated with a thin pulpy covering, of which a favourite beverage is made; it is, however, their hardness and white colour which give them a commercial value; they are largely imported, and are being made into buttons, umbrella handles, knobs for doors, workboxes, and toys. Seeds of this plant were received at Kew in 1845, and in 1864, a plant in the Palm House had leaves 16 feet in length.

Macaw tree or Gru-gru (*Acrocomia sclerocarpa*). A wing-leaved palm, having a trunk 30 feet high covered with strong spines. It is a native of Jamaica, Brazil, and other parts of tropical America. The nuts are globose, about the same size as those of the "Ivory nut," and being very hard take a fine polish. They also yield a fine scented oil used in the manufacture of toilet soap.

Rasp Palm (*Iriartea exorrhiza*). A native of Brazil and Central America. Its growth is remarkable, the trunk being elevated on stout aërial roots, which diverge from its base in a slanting direction, giving to the tree the appearance of being supported on props in such a manner and height that a man can walk beneath them. These supporting roots are hard and straight, 6—8 inches in circumference, and being covered with rough tubercles are cut into convenient lengths and used by the natives for grating "cocoa nuts" and for other purposes.

Chair Cane (*Calamus Rotang*, *C. rudentum*, *C. verus*, and *C. viminalis*). These species are natives of India and the

Malayan Islands, having slender reed-like stems, which grow to a great length, often from 150 to 200 feet, spreading over trees and rambling in every direction. The stems and foot-stalks of the leaves are generally furnished with stiff hooked prickles. They are known by the name of rattans, and are largely imported to this country for making chair-bottoms, umbrella-ribs, and for other purposes, being used as a substitute for whalebone.

Dragon's Blood (*Calamus Draco*). A native of the same countries, and similar in habit to the preceding species. Its fruit grows in bunches and are about the size of cherries, consisting of imbricated scales of a rich shining red colour, caused by a coating of wax which is collected by shaking them in bags. After being run together into sticks or cakes, it is imported and used in staining wood, for varnishes, &c.

Malacca Cane (*Calamus Scipionum*). An erect, slender-stemmed palm, having distant joints. When cut and dried they are of a beautiful chestnut-brown colour, and are made into the much admired Malacca canes, which were once carried by livery servants behind carriages.

Several species of Calamus are natives of Sikkim, one of the most important being *C. montanus*, of which suspension bridges are made in India. It is also twisted into ropes, and used for other purposes where great strength is required.

In tropical America, climbing palms are represented by *Desmoncus* and several species of *Chamædorea*, which in New Granada are twisted together and used in forming suspension bridges.

THE LILY AND HELLEBORE ALLIANCE.

The Spider-wort Family.

(Commelynaceæ.)

Perennial, or annual herbs; or soft, jointed, erect, or trailing-stemmed fruticuls; either rooting on the ground or epiphytal. Leaves simple, sheathing at their base. Flowers naked, or many together in a bivalved involucre. Sepals

and petals 3 each. Stamens 6—9 part abortive, some having fringed filaments. Fruit a 2—3-celled capsule.

About 250 or more species constitute this family. They are found chiefly within the tropics, and in New Holland, a few in N. America, but none in Europe or Northern Asia. The tuberous rooted species contain starch, but are not of any economic importance. They are pretty, ornamental garden plants, some being extremely interesting, such as—*Tradescantia virginica*, an old garden perennial with white, pink, and blue flowers, the filaments of which are furnished with a fringe of jointed hairs. The jointed appearance is due to the hairs being composed of cells placed end to end, and when viewed under the microscope each cell is seen to have an independent circulation of sap. *T. discolor*, *T. rufa*, and *T. zebrina* (a pretty variegated species), *Dichorisandra thyrsiflora*, *Spironema fragrans*, and *Aneilema crispata* are pretty flowering hot-house plants. The most remarkable plant of the family is *Cochliostema Jacobianum*, a native of Ecuador, and which has been introduced within the last few years to the gardens of Europe. It is a stemless epiphyte, having numerous spreading leaves 3—4 feet long, and 14 inches in breadth, of an oblong-lanceolate form, and having the appearance of a large-leaved *Anthurium*. The peduncle is more than a foot high, bearing a panicle of blue flowers, each flower being more than 2 inches in diameter. Much of the peculiarity of the plant rests in the character of its stamens, which are enclosed in a kind of hood.

The Hellebore Family.

(MELANTHACEÆ.)

Bulbo, rhizo, or phyllocorms. Leaves grass-like, or broad, in tufts. Flowers in spikes or racemes, or solitary. Sepals and petals 6, uniform, free, or united at the base. Nearly 150 species are enumerated as belonging to this family, the greater number being natives of temperate countries in both hemispheres. They are widely distributed,

and the greater number are poisonous, some being of a very virulent nature. The only native representatives are *Colchicum autumnale* and *Tofieldia palustris*, the latter a grassy-leaved plant growing in waste places in the north of England and Scotland.

Colchicum (*Colchicum autumnale*). This is rarely found wild, although it is common in gardens. It is known as "Meadow Saffron," and "Autumn Crocus." It has a solid, bulbous root (*corm*), from which crocus-like flowers are produced in the autumn, succeeded by grass-like leaves. It is found throughout the warm parts of Europe, and is highly poisonous, but it is of importance in medicine, more especially for gouty affections.

White Hellebore (*Veratrum album*). A perennial plant, native of some parts of Europe, especially Alpine regions. It has broad, elliptical, pointed leaves, with prominent longitudinal veins, and a flower-stem rising to the height of 3—4 feet bearing panicles of greenish-white flowers. The roots are thick and fleshy, of a poisonous nature, and though sometimes used medicinally, are not of much repute in this country.

Sabadilla (*Asagræa officinalis*). A native of Mexico. The poisonous principle *veratrine* is obtained from it, being used in medicine, and for destroying vermin.

Fly poison (*Amianthium muscœtoxicum*). This is a native of N. America. It is injurious to cattle, and is used as a fly poison.

The genera *Methonica* or *Gloriosa*, *Littonia*, and *Sandersonia*, are represented by 6 or more species, natives of west tropical Africa, Natal, and India. They are herbs with slender, flexuose, leafy flower-stems, which rise from round, oblong, or lobed bulbo-corms. With the exception of *Sandersonia* the leaves terminate in a tendril by which the stem climbs. The species of *Methonica* attains the height of 6 or more feet, and produce large showy flowers on axillary peduncles. The perianth lobes are reflexed, and the long style is bent horizontally at a point a little above the ovary.

Botanists are not agreed as to the relative position of this

small group, some placing them with lilies, others referring them to the present family, and their solid corms seem to indicate this as their proper place.

The Lily Family.

(Liliaceæ.)

Plants varying in habit, the extremes of which are represented by Dragon-trees, Lilies, Butcher's-broom, and its climbing associates. Leaves always simple, glabrous, rarely villous, grass or sword-like, or elliptical. Flowers produced in various ways. Sepals and petals 6, generally uniform in size and colour, free or united at the base, forming a perianth. Stamens 6. Pistil simple, or 3-lobed. Fruit a many-seeded, 3-celled capsule, or a fleshy berry.

About 1200 species are enumerated as belonging to this interesting family; they present such diverse variation in habit and technical character, as to have been classed by some botanists under different families, and it will best suit this work if we artificially arrange them according to their mode of growth as regards roots and stems. They are widely distributed, being chiefly natives of temperate countries both in the North and South hemispheres. In Europe they are represented by *Allium*, and *Ornithogalum;* in America and Japan, by *Lilies;* in Mexico, by *Yuccas;* in Africa, by *Aloes*, *Dracænas*, and various bulbs; and in Australia, by Grass-trees (*Xanthorrhœa*).

They are of considerable importance, both for food and also for economic and domestic uses. Many have a medical reputation, irritant, and, of a drastic, purgative nature, some even being poisonous.

I. Lily Group.

Herbs with compact (bulb-like) phyllocorms growing on or under the surface, with annual, soft, flaccid leaves. Scape simple, or compound, bearing from one to many flowers,

arranged in heads, umbels, spikes, racemes, panicles, &c. Flowers generally large and showy. Fruit a capsule.

Onion (*Allium cepa*), Leek (*A. Porrum*), Garlic (*A. sativum*). It is scarcely necessary to describe these useful and well-known esculents. They are extremely ancient, for we read* that leeks, onions, and garlic were cultivated in Egypt in the time of Moses, and in course of time found their way to western nations, although it is not improbable they were originally natives of Southern Europe. The leek is said to be wild in Switzerland.

Rocambole (*Allium scorodoprasum*), Shallot (*A. ascalonicum*). These have bulbs similar to garlic, but are much milder. They are more extensively used on the continent than in this country. The last named species is a native of Palestine, and derives its specific name from Ascalon, where it grows in great abundance. It has been cultivated from time immemorial by all the civilized nations of the East, entering largely into their daily food. It appears to have been used in England about the middle of the 16th century; the onion probably at a much earlier date.

Chives (*Allium Schœnoprasum*). A native of the North of Europe. It has hollow grass-like leaves, and is commonly cultivated in kitchen gardens.

Star of Bethlehem (*Ornithogalum umbellatum*). This is found in different parts of Europe and Western Asia, and is also a native of this country. Its flowers are of a milky white, borne in umbels, and it is probably on this account that it has received the name "Ornithogalum," which literally means "bird's milk." Some suppose that the bulbous roots of this plant were the "dove's dung" spoken of in Kings,† but there is not sufficient proof for this supposition.

Ornithogalum pyrenaicum is also a native of this country, abounding in some parts of the southern counties, especially

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* Numbers, chap. xi. ver. 5.

† Book II. chap. vi. ver. 25.

about Bath, where the young flower-stalks are collected, and eaten like asparagus.

Quamash (*Camassia esculenta*). A bulbous-rooted plant with blue or white flowers. It is a native of North America, where it grows very abundantly, and its roots form a large proportion of the vegetable food of the Indians.

Squill (*Scilla maritima*). A large bulbous-rooted plant found on the coasts of the Mediterranean, and also abundant at Malta, from whence it is imported. It is used in medicine, being a powerful irritant, and is prescribed in dropsical and other complaints.

Tulip (*Tulipa Gesneriana*). The tulip is said to be a native of the Levant, the specific name being given in honour of a botanist named Gesner, who was the first to describe and figure it in 1559. It appears to have been cultivated in this country about 1577. The original or wild plants have yellow flowers, but cultivation has produced hundreds of beautiful varieties, varying greatly both in colour and size. Formerly some of these varieties were so famous that high prices were paid for the bulbs, which in Holland became a speculative mania, bulbs representing scrip to a large amount, and even scrip circulated on ideal bulbs. For many years they have been favourite objects of cultivation and competition amongst florists in this country.

Crown Imperial (*Fritillaria imperialis*). A native of the South of Europe and Western Asia. It was introduced to this country about the end of the sixteenth century. Besides the brown flowered varieties there is one with pure yellow flowers. Their bulbs contain starch equal in quantity to the potato. *F. meleagris* is a rare British plant, being found only in one or two localities, one of which is the meadows between Kew and Mortlake. It has solitary nodding flowers beautifully chequered with reddish-brown.

Lilies. Many species of these beautiful plants are cultivated in gardens, of which the following are the most admired. Common White Lily (*Lilium candidum*), Orange Lily (*L. bulbiferum*), Martagon Lily (*L. martagon*), Chalcedonian Lily

(*L. chalcedonicum*), Tiger Lily (*L. tigrinum*), Lance-leaved Lily (*L. lancifolium*), Golden-striped Lily (*L. auratum*), and the pretty slender-leaved Lily (*L. tenuifolium*).—In addition to those already named others are sometimes, though more rarely, found in gardens. They are natives of Greece, Eastern Europe, Levant, China, and Japan. The Golden-rayed Lily of Japan (*L. auratum*) was introduced in 1863, producing under good cultivation flower-stems 5—6 feet high, bearing very large sub-erect white flowers, richly spotted with purple and banded with gold; the flower is sometimes a foot in diameter. *L. giganteum*, a native of Nepal, is a magnificent species, with large elliptical leaves, and erect flower stems 6—8 feet high, bearing large pendulous white flowers. In this country it requires the protection of the greenhouse.

Much difference of opinion exists as to the plant spoken of in the Scriptures as "Lily of the Valley,"* some referring it to *L. candidum*, others to *L. chalcedonicum*, both of which are abundant in some parts of Palestine. With regard to the "Lilies of the field"† spoken of in St. Matthew's Gospel, it seems to signify all pretty wild flowers.

Tuberose (*Polianthes tuberosus*). This is said to be a native of the East Indies, but has been long introduced to the South of Europe, and is at present extensively cultivated in Italy, from whence its bulbs are largely imported to this country. It derives its generic name from *polis*, a city, and *anthos*, a flower, literally "flower of the city." It must not be confounded with the generic name "Polyanthus" of the Primrose Family.

Soap Bulb (*Chlorogalum pomeridianum*). A native of California, and has the remarkable property of "lathering" in water like soap, this effect being produced by the mucilage, it containing neither oil nor alkali.

Hyacinth (*Hyacinthus orientalis*). A native of Syria and

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* Song of Solomon, chap. ii. ver. 1.

† Chap. vi. ver. 28.

other parts of Western Asia. It was introduced to this country before the end of the 16th century, and is a favourite spring flowering bulb, there being many single and double varieties of various colours. It is extensively cultivated at Haarlem, in Holland, where there are large farms devoted entirely to the growth of this and other bulbous plants, for the supply of this country and other parts of Europe and America.

II. Asphodel Group.

Plants growing in tufts, without evident stems (phyllocorm) having long, linear, or strap-shaped leaves, often channelled, and sometimes sword-shaped. Roots fascicled or cord-like.

Silver Rod, King's Spear (*Asphodelus ramosus*). Found in great abundance in the vicinity of Palmyra in Syria, where its roots are extensively collected, and form an article of trade to Damascus and other places in Palestine. They are ground into meal, and made into paste used in bookbinding, shoemaking, and such like. Golden Rod (*A. luteus*), Day Lily (*Hemerocallis flava* and *H. fulva*), are well known showy garden plants.

Tritoma uvaria. A native of the Cape of Good Hope, is cultivated as a border plant. It has long, narrow, channelled leaves, and bears spikes of vermilion-coloured flowers 2—3 feet high, and when seen at a distance is not unlike a red-hot poker in appearance, whence it is commonly known in this country as the "Red-hot Poker plant."

Love Flower (*Agapanthus umbellatus*). Introduced from the Cape of Good Hope to this country about the end of the seventeenth century. It has long strap-shaped leaves, and bears large umbels of pale blue flowers on scapes 2—4 feet high. It is a beautiful plant cultivated in greenhouses.

III. Aloe Group.

Simple, or branched Palmids, or free, above-ground, perennial phyllocorms. Leaves grass, or sword-like, in Aloes

thick and fleshy, and then often short and obtuse. Fruit a capsule.

Aloes. This genus consists of about 150 species, which vary extremely in size and general appearance. They are chiefly natives of South Africa and the African islands. Many species have been long cultivated in the gardens of Europe.

Partridge-breasted Aloe (*Aloe variegata*). This is frequently seen in cultivation as a window plant, and is a type of the "stemless group," while *A. africana* and *A. ferox* have cylindrical stems 8—10 feet high. The juice exuding from the succulent leaves of these, and also from *A. plicatilis* and *A. purpurascens* yield the purgative bitter aloes, a large quantity of which is imported from the Cape of Good Hope. This is, however, of inferior quality; the best is that obtained from *A. socotrina*, a species which grows abundantly and gives a special character to the hot, dry island of Socotra, in the mouth of the Red Sea. This is generally sent from Socotra to Bombay, and is imported to this country under the name of Bombay Aloes.

A species called Barbadoes Aloe (*A. vulgaris*) is generally admitted to be a native of the Island of Barbadoes, but was most probably introduced from the coast of Africa by the slaves during the early settlement in that island. The drug "aloes" forms an important ingredient in patent purgative medicines. It must be distinctly understood that the plants of this family are not the "aloes" of Scripture.

Yucca. The species of this genus are natives of Mexico and other parts of tropical America. Some species are stemless, while Adam's Needle (*Y. gloriosa*) has palmid stems which, under favourable conditions in this country attain the height of 4—6 feet, and 6 or more inches in diameter. They are often branched, each branch being terminated by a tuft of lanceolate or sword-shaped leaves, from which rise a panicle 2—3 feet high, bearing large pendulous white flowers. All the species contain a large quantity of fibre in their leaves, which is extensively used in the countries where they are abundant.

New Zealand Flax (*Phormium tenax*). A distinct plant, with smooth, sword-shaped leaves, 4—6 feet long, of a firm texture and abounding in stout fibre. The flowers are red, borne on a scape in panicles. Scape 10 or even more feet in height. In New Zealand it occupies large tracts of the country, and is used by the natives for making ropes, mats, &c. Large quantities have been imported to this country. It is tolerably hardy, and about fifty years ago a company was established for its cultivation in the South of Ireland, but its slow growth caused it to be abandoned.

Grass Gum Trees (*Xanthorrhœa*). This remarkable genus consists of 9 or 10 species, natives of Australia. They hold the same position in Liliaceæ as Kingia does in Juncaceæ. Stems cylindrical, formed by the broad bases of grass-like leaves, and attaining a foot or more in diameter. *X. arborea* and *X. quadrangularis* attain the height of 6—10 feet, and the flower-stem springs like a stout rod from the centre of the crown of leaves, and frequently is 10—20 feet long, the upper part being densely covered with small yellowish-white flowers. The leaves are often burnt by the grass-fires, leaving the blackened stems standing, which at a distance have the appearance of black men, from which circumstance the name "Black boy trees" has been applied to them. The smaller species look like thatched beehives. They yield a fragrant resin of two kinds, called "Black Boy" and "Botany Bay" Gum, and contain abundance of Picric acid, which is extensively used in the preparation of the highly explosive compound, "Picrate of Potassium." This acid is used for dyeing silk and wool, and imparts to them a yellow colour. The gum resin is made into candles, and is used in some Roman Catholic churches as incense.

These plants are of very slow growth, it requiring many years before they produce a stem, as shown by an example of a plant at Kew thirty years old and still stemless.

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IV. Dragon-Tree Group.

Simple or branched palmids, or annual or perennial leaved rhizocorms. Leaves sword-shaped, linear, or elliptical. Fruit a berry.

Dragon's Blood Tree (*Dracæna Draco*). A remarkable tree, native of the West Coast of Africa, Canaries, and adjacent islands. Young plants of this have a similar appearance to *Yucca gloriosa*, but it grows into a large tree; after having attained a certain height it produces branches. The famous Dragon Tree of Orotava, in Teneriffe, believed to be the oldest vegetable organism in the world, is stated to have been 70 feet high, and 48 feet in circumference. Its stem was hollow and had a staircase in it as high as the point where its branches commenced. It was entirely destroyed in 1867, having previously suffered much from storms. A portion of one of its branches is preserved in the Kew Museum. *Dracæna Draco* was introduced to the Royal Gardens many years ago, and in 1864 one specimen had attained the height of 30 feet, bearing a crown of sword-shaped leaves on a cylindrical stem 6 inches in diameter. The red gum called Dragon's Blood is obtained from this plant, but only in small quantities. It must not be confounded with the Dragon's Blood of commerce, which is obtained from *Calamus Draco*, a native of Java and Borneo.

Dracæna terminalis is common in the Sandwich Islands and in the islands of the Pacific generally, and is known by the name of "Ti." It has thick fleshy roots which contain large quantities of saccharine matter, from which the natives extract sugar. They also bake and eat the roots, and a spirituous liquor is obtained from them by distillation.

Of late years numerous ornamental species of Dracæna have come into notice, some having beautifully variegated foliage. They are favourite show plants, being frequently seen at horticultural exhibitions.

Bowstring Hemp (*Sanseviera guineensis*). A native of tropical Africa, having long strap-shaped leaves 2—4 feet

long and 2—3 inches wide. *S. Roxburghiana*, a native of India, has flat leaves similar to the last, but in *S. angolensis*, native of W. Tropical Africa, the leaves are cylindrical, and about 1 inch in diameter. The leaves of these plants contain much fibre, which is used for making ropes, and it is stated that the latter produces the best of any kind of fibre for deep-sea dredging lines, &c.

Lily of the Valley (*Convallaria majalis*). A native of Britain, being generally found in shady places, in woods, and is commonly cultivated in gardens for its pure, waxy, sweet-smelling flowers. This is *not* the Lily of the Valley spoken of by King Solomon.

Solomon's Seal (*Polygonatum multiflorum*). A plant found wild in many parts of England, and is frequently cultivated in gardens. Its creeping roots or rhizomes are in great repute, as they quickly remove bruises and discolorations of the face resulting from blows.

V. Asparagus Group.

Rhizocorms, or partially gemmæcormous herbs, shrubs, or trailing, or climbing ampelids. Leaves small, acerose, or lanceolate elliptical. Flowers small, not showy.

The natural habit of this family is similar to sarsaparillas, in which family they are placed by some botanists. The chief difference is in their leaves not being net-veined.

Asparagus (*Asparagus officinalis*). A native of the sea-coast in the southern counties of England. It also covers large tracts of country in Poland and Russia, and other parts of Europe. It is said to have been cultivated by the Romans before the Christian era. It is extensively grown as a spring vegetable in the vicinity of London and Paris. There are several species from S. Africa and India, having climbing or trailing stems, often spinose. The climbing character of this group is represented in Australia by *Eustrephus latifolius* and *Geitonoplesium cymosum*, long since introduced to this country and cultivated as greenhouse climbers.

Allied to *Asparagus* is the curious genus *Ruscus*, of which Butcher's Broom (*R. aculeatus*, *R. Hypophyllum*, *R. Hypoglossum*, *R. racemosus*, and *R. androgynus*) are examples. The first four being cæspitose shrubs 1—3 feet in height and natives of Europe—the latter being a climber from the Canary Islands. In all the leaves are alternate, elliptical, acuminate, and persistent. Their flowers are small, monœcious, or diœcious; in the three first named species they are borne on the disc of the leaves, and in *R. androgynus* on the margin analogous to *Xylophylla* (*see* p. 33). This singular mode of flowering has led some botanists to consider the so-called leaves, branches, but on noting their regular alternate evolution, definite size, form, and texture, in conjunction with the fact that *R. racemosus* produces its flowers in terminal racemes, quite free from the foliage, I am led to think that they are *true* leaves, having (*R. racemosus* excepted) the floral peduncle adnate, or amalgamated with the midrib of the leaf, as is the case with *Erythrochiton hypophyllanthus* and *Turnera ulmifolia*, hothouse plants. *Ruscus racemosus* is known as the Alexandrian Laurel.

Allied to Liliaceæ is a small family of aquatic plants—Pontederaceæ—consisting of about 30 species, widely distributed, but possessing no special economic uses. *Pontederia cordata*, a native of N. America, is a neat plant, with heart-shaped leaves and a spike of pretty blue flowers. It is perfectly hardy in this country. *P. cærulea* is a singular plant from the W. Indies and tropical America, having roundish heart-shaped leaves borne on a thick, swollen petiole full of air-cells, by which the plant floats on the surface of the water. It produces offsets freely, soon extending itself over a large surface. It rarely flowers in this state, but when it becomes attached to the soil its footstalks become long and narrow, and it then produces its pretty blue flowers.

THE SARSAPARILLA AND YAM ALLIANCE.

The Sarsaparilla Family.

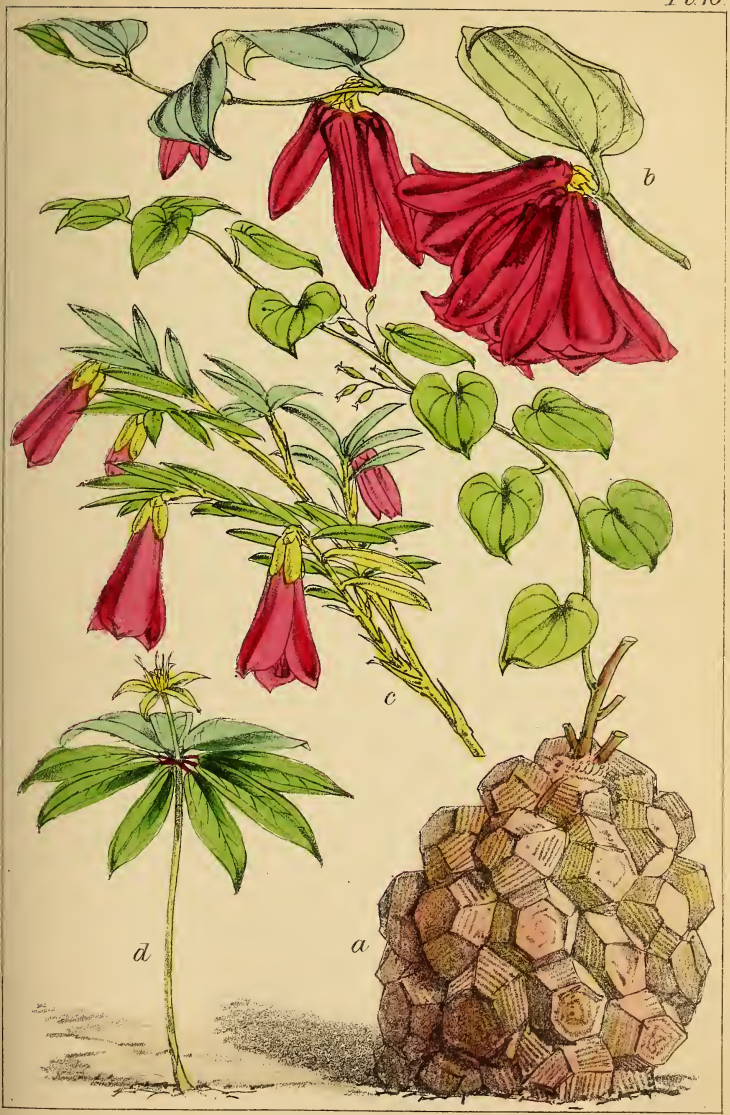
(Smilaceæ.)

Perennial, often cæspitose, woody stemmed climbers, with slender root-like rhizomes, rarely herbaceous. Leaves alternate.

This family somewhat resembles the next, but is technically distinguished by characters in the flower and fruit; also by their stems being firm and woody, and the leaves more permanent.

This alliance presents externally all the characters of rambling, evergreen, exogenous shrubs. Their flowers are small, and generally diœcious. The family is composed of about 120 species, being widely distributed in both tropical and temperate countries. From the genus Smilax the celebrated and well-known medicine Sarsaparilla is obtained, being extracted from the rhizome-like roots of several species. It varies in quality, and consequently in both value and usefulness according to the country and particular species from which it is obtained. The principal imports are from the West Indies, Brazil, and other parts of tropical America. *Smilax officinalis*, *S. siphilitica*, and other species also produce the extract; as also species from the East Indies and China. *S. aspera* and *S. mauritanica* are natives of countries adjoining the Mediterranean, and are hardy in sheltered situations in this country.

Allied to Smilaceæ is the family Philesiaceæ, which consists of two known genera—viz., *Philesia buxifolia*, a pretty evergreen shrub with pink tubular flowers. It is a native of Chili, and extends to the Straits of Magellan. The other is the still more beautiful greenhouse-climber *Lapageria rosea*, with pendulous, lily-like flowers of firm substance, and of a fine pale crimson or rich rosy colour spotted with white.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This is also a native of Chili, and has a variety (*L. rosea v. alba*) with pure white waxy flowers.

Another singular climbing plant of this alliance is *Roxburghia gloriosoides*, a native of India, and which is by some botanists placed in a distinct family—*Roxburghiaceæ*.

Another small family of about 30 species, *Trilliaceæ*, is also allied, and is chiefly represented by the genera *Trillium* and *Paris*, which consists of perennial herbaceous plants, with whorled leaves, bearing terminal flowers, and are chiefly natives of temperate countries, many of North America. In this country they are represented by *Paris quadrifolia*, found on the outskirts of woods, but rare. Its roots are of a poisonous nature, and the plant is popularly known as "Herb Paris."

The Yam Family.

(Dioscoreaceæ.)

Plants with solid, fleshy, underground tubers, or woody above-ground corms, and producing climbing stems, which are slender, and either perennial or herbaceous. Leaves alternate, rarely opposite, more or less heart-shaped, with well-marked longitudinal veins, which anastomose laterally. Flowers small, produced in loose, pendulous spikes, and generally unisexual. About 150 species are enumerated as belonging to this family, all being widely distributed throughout the tropics, and represented in this country by Black Bryony (*Tamus communis*). An acrid principle is contained in most of the species, some even being poisonous, but cultivation renders them harmless.

Yam (*Dioscorea sativa*, *D. aculeata*, and several other species), are natives of India and other warm countries of the East, where they are extensively cultivated and take the place of the potato of more temperate climes. There are many varieties varying in size and quality, but all contain more or less of a nutritive farina. The yam was early introduced to the West Indies, where it forms a great part of the

food of the negro population. Yams are imported to this country, but not in any quantity.

Chinese Yam (*Dioscorea Batatas*). This is extensively cultivated in China and Japan. It differs from the preceding in having a long, spindle-shaped black root, about the size of a parsnip, 2—3 feet long. It has been introduced to this country and is perfectly hardy, indeed at one time expectations were entertained that it might prove a good substitute for the potato, but as long as potatoes are to be had it will not find much favour, being far inferior to them as a vegetable.

Tortoise Plant or Elephant's Foot (*Testudinaria elephantipes*). A most remarkable plant, native of South Africa. It consists of a large, woody, above-ground corm-stem, generally of a conical form, having a diameter of from 3—4 feet, and as much in height, of a fleshy, fibrous substance, being covered with a hard, woody, tessellated coat composed of numerous angular protuberances, and producing from its apex slender, twining, herbaceous stems. Leaves small, cordate. Flowers small, yellow. It was originally used by the Hottentots as food, and was called "Hottentot Bread." The popular name "Elephant's Foot" is given it from the resemblance which small plants bear to the rough foot of that animal. Large plants of it are frequently imported to this country.

Section II.—Ovary inferior.

THE NARCISS, AMERICAN ALOE, AND PINE-APPLE ALLIANCE.

The Narciss Family.

(Amaryllidaceæ.)

Simple, or rarely branched palmids, or solitary, cæspitose, perennial phyllocorms, or bulbocormous herbs. Leaves grass, strap, or sword-like, or variously oblong elliptical. In *Agaves* thick and fleshy. Inflorescence a simple or branched

scape, or in some herbs a leafy stem. The simple scapes bear one or more flowers enclosed in a spathe, while in *Agaves* the flower-stem is branched 30—40 feet high Corolla straight, regular, or oblique, and partially bilabiate. Fruit a 3-celled, many-seeded capsule; or succulent, berry-like, and few-seeded. This family is represented by plants similar in habit and general character to those of the Lily family, but differing in the ovary being inferior, the bulbo-corms solid, and not coated as in Lilies.

About 400 species constitute this Family; they are widely distributed in both temperate and tropical countries. They vary much in habit, being bulbous rooted plants, represented in Europe by the Snowdrop and Daffodil. At the Cape of Good Hope and in Brazil and Peru, by numerous species of *Amaryllis*. In Mexico and tropical America by American Aloes, in tropical Asia by the genus *Crinum*, while Australia claims the splendid *Doryanthes excelsa*.

Daffodil (*Narcissus pseudo-Narcissus*). This species, together with Jonquil and the "poet's Narciss," are well known spring flowers. They are, however, not entirely harmless, as they contain a degree of poisonous acridity.

Polyanthus Narcissus (*Narcissus Tazetta*). A native of Southern Europe and Western Asia, being abundant in Palestine, and during the flowering season it is to be found in nearly every house, especially in Damascus. By some this is considered to be the "Rose of Sharon"*—the original Hebrew word bulb being translated "rose;" and indeed a rosebud is something similar to the bulbs of this plant.

Belladonna Lily (*Amaryllis Belladonna*). This, with *Nerine sarnienis*, of the Cape of Good Hope, has become naturalized in Guernsey, from whence bulbs are brought yearly to the London markets under the name of "Guernsey Lilies." They are easy of cultivation, and flower in the open air when planted in a warm, sheltered situation. Many

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* The Song of Solomon, chap. ii. ver. 1.

species of Amaryllis having showy flowers are cultivated in hothouses.

Hæmanthus toxicaria is poisonous, and was used by the Hottentots for poisoning their arrows. *H. puniceus*, a native of Tropical West Africa, and several other species, have beautiful red flowers, which are closely packed together in a head, the projecting stamens giving them the appearance of brushes.

American Aloe (*Agave Americana*). A native of Mexico and Central America. It is well known in the gardens of this country, and is said to have been introduced about the middle of the 16th century. The variety with golden striped foliage is the greatest favourite. This plant has long enjoyed the reputation of producing its flowers but once in a hundred years, and that when it did so it made a report like a gun. The truth is, that a plant may be forty or fifty years of age before it does flower; and formerly there being but few plants in the country, the report of its being in bloom spread rapidly; this accounts for the latter part of the rather fanciful tale. The flower stem grows at a rapid rate, often 6 inches per diem. The plant, after flowering, dies, but previous to this it throws up numerous "suckers," by which the plant is propagated. It has become naturalized in Spain and other parts of Europe. In Mexico it forms impenetrable fences, and is, moreover, of great importance to the inhabitants, affording their national drink "pulque," which is obtained by cutting out the young flower bud, when the cavity becomes filled with liquor, which is collected daily. It contains a large quantity of sugar, and after fermentation an intoxicating spirit is made from it. The odour of the beverage is disagreeable to Europeans, but the repugnance once overcome it is relished.

There are many different species of this genus, and also of *Fourcroya* an allied genus. They are common throughout Venezuela, New Grenada, and other parts of tropical America, being known by the name "Magua."

Their thick fleshy leaves contain a large quantity of

strong fibre, the cleaning and preparation of which forms a native trading occupation. It is known as "Pita thread," and is useful for making ropes, mats, and for many articles of domestic use.

Probably the most remarkable plant of the family is *Fourcroya longæva*, a native of Mexico. Its stem rises 20—30 feet high, and is 12 inches in diameter, with erect arms or branches near the top, each terminated by a crown of lanceolate, glaucous leaves. The flower-stem rises from the centre of the crown 20—30 feet high, bearing numerous pale flowers. It forms a peculiar feature in the landscape, and presents a striking contrast to the modest Snowdrop (*Galanthus nivalis*) of this country.

The Pine-apple Family.

(Bromeliaceæ.)

Simple or branched palmids, or solitary or cæspitose perennial phyllocorms, many epiphytal. Leaves grass, strap, or sword-like, or variously oblong elliptical, spreading or erect, with their margins imbricated, forming a tube. Flowers in spikes, racemes, panicles, or compact heads; often with large showy coloured bracts. Calyx tubular or 3-parted. Petals 3, white, pink, or blue. Fruit a dry capsule, or united and succulent, as in the pine-apple.

Nearly 200 species constitute this family; they are wholly natives of tropical and subtropical America. *Tillandsia* and *Billbergia* being epiphytal plants, growing in tufts, the bases of their closely imbricated, sheathing leaves forming reservoirs which hold water throughout the dry season.

Pine-apple (*Bromelia ananas*). The original country of this is supposed to be Brazil; it first became known to Europeans about the middle of the 16th century. It now exists in both a cultivated and wild state in all warm parts of America. It was introduced to West Tropical Africa, where it has become naturalized, as also in the warm

parts of Asia. Its fruit consists of a number of ovaries, cohering in a firm head, and terminated by a tuft of small leaves.

The pine-apple appears to have been known in England in the time of Charles II., who is recorded as having at a royal dinner-party first cut up one, but it is not certain whether it was grown in this country or imported. It is recorded as having been introduced to this country in 1690, and there is evidence of its being cultivated soon afterwards, and many varieties are now grown in hothouses.

Of late years large quantities have been imported from the West Indies, chiefly from the Bahamas, and it is not uncommon to hear the cry of "Pine-apple a penny a slice" in towns, but they are inferior to those grown in hothouses. The name pine-apple is given on account of the fruit resembling the cones of the Pine or Fir-tree. In India, Burmah, and other parts, the tough fibre of the leaves is largely used in the manufacture of textile fabrics. It partakes of the nature of flax, and may be spun very fine.

The Wild Pine of Jamaica (*Bromelia Pinguin*). This has long stiff leaves, with strong spines, forming when growing close together an impenetrable barrier. They contain a great quantity of fibre useful for rope, or paper making.

American Moss (*Tillandsia usneoides*). A small epiphyte, native of tropical and subtropical America, growing in profusion on the Cypress trees in the regions of the Mississippi. In Jamaica it is called "Old Man's Beard." It has slender leaves, 4—6 inches long, which after being subjected to some peculiar process it is used as a substitute for horsehair, and is imported to this country.

Dasylirion acrotrichum. A native of Mexico, having a palmid stem 2 or more feet high, terminated by a tuft of rigid linear leaves 2—3 feet long, from the centre of which the flower-stem is produced 15 feet in height. The leaves have spiny margins, and contain much fibre.

Many fine plants belonging to such genera as *Billbergia*, *Tillandsia*, *Vriesia*, *Puya*, *Dyckia*, *Pourretia*, &c., have long

been introduced to Kew. *Puya chilensis* is a native of the west coast of tropical America and North Chili, where it occupies large tracts forming impenetrable thickets. It has long recurved leaves, armed with hooked spines, and contains fibre in abundance. It forms a branched stem 3—4 feet high.

Dyckia argentea is a beautiful sub-hemispherical plant, with gracefully recurved silvery leaves 2 feet long, having stout hooked spines along their margins.

THE GINGER, AND BANANA ALLIANCE.

The Ginger Family.

(ZINGIBERACEÆ.)

Herbaceous plants with a creeping rhizome, which is often branched, or consists of bunches of tubers; stemless, or producing reed-like stems. Flowers radical, or on leafy stems. Leaves alternate, entire, elliptical, lanceolate or sword-shaped, with parallel veins diverging from the mid-rib to the margins. Stem 1 or more flowered, furnished with sheathing bracteæ. Fruit generally a 3-celled capsule, sometimes pulpy and berry-like.

Ginger (*Zingiber officinale*). This is universally cultivated throughout the tropics, and it is impossible to state its native country, but probably it is India. Ginger of commerce is the rhizome or underground stem, which is lobed or fingered in a peculiar manner, and produces reed-like stems, clothed with grass-like foliage. Many varieties are in cultivation in tropical regions. It is imported to this country in its dried and bleached state from both the East and West Indies, Africa, and China, but Jamaica Ginger is considered the best.

Turmeric (*Curcuma longa* and *C. rotunda*). Stemless plants having elliptical leaves rising from a fascicle of tuber-like roots which differ in form, some being round, others long and narrow, but now considered to be only different states of one species.

It is in general cultivation throughout the whole of the Eastern tropics, the Polynesian, and most of the Pacific islands. The tubers yield the yellow dye "Turmeric," which is used in cookery for colouring curries, confections, &c. It is greatly used by the natives of the Pacific islands for painting their bodies, which they often do in various colours, imitating the dress of Europeans.

Galangale (*Kæmpferia Galanga*). This has tuberous roots, which are used in India as an aromatic stimulant. It is cultivated in hothouses, the flowers making their appearance before the foliage, in a manner analogous to the "Autumn Crocus."

Grains of Paradise or Malaguetta Pepper (*Amomum Grana-Paradisi*). A native of West Tropical Africa. It throws up a reed-like, herbaceous stem, which produces a terminal pod or capsule containing the seeds to which the above names are applied. They are carminative, aromatic, and are fraudulently used to give a false strength to beer and liquors. Grains of Paradise are also produced by other species of the genus grown in India.

Cardamoms of commerce are the fruit of *Elettaria Cardamomum*, which grows abundantly both wild and cultivated in many parts of India, particularly Malabar. It has a reed-like stem, which is perennial, producing fruit for several successive years. The patent medicine "Solomon's Balm of Gilead," is principally prepared from cardamoms.

Alpinia nutans. A native of India, growing in dense masses and having reed-like stems with broad, elliptical, lanceolate leaves, and bearing a pendulous spike of white flowers, which have a pearl or shell-like appearance. The whole plant is strongly aromatic. It is easy of cultivation, and very ornamental in hothouses, as also is the beautiful *Hedychium Gardnerianum*, and its congeners *H. heteromalum*, and other species. They have thick fleshy rhizomes, and produce leafy stems 4—6 feet in height, terminated with cylindrical spikes of perfumed yellow or white flowers.

Costus speciosus, a native of the East Indies, and *C. afer*,

a native of West Tropical Africa, are handsome plants, having round, compact heads of red, yellow, or white flowers. The latter species is in great repute as a preventive of sea-sickness.

The Arrow-root Family.

(MARANTACEÆ.)

These plants agree in habit and general appearance with the Ginger family, but they are entirely destitute of aroma, have no perfume, and are technically distinguished by their broad, petaloid stamens, two of which are rudimentary or abortive.

About 160 species are enumerated as belonging to this family. They are decidedly tropical, the greater number being from tropical America. Their roots contain a large quantity of starch.

Arrow-root (*Maranta arundinacea*). This is extensively cultivated in the West Indies, and is a native of tropical America. It is a reed-like plant, and arrow-root is obtained from its fleshy rhizomes by maceration, washing, and drying. There are several varieties, one with dark-coloured stems and leaves is cultivated in Trinidad. In the East Indies arrow-root is obtained from *M. ramosissima*. The name "arrow-root" is said to be derived from the circumstance of the Indians applying the roots to wounds received from poisoned arrows.

A great number of variegated Marantas and Calatheas with beautifully mottled or streaked foliage have been introduced from tropical America, and form attractive objects in our hothouses and plant-stoves. *Calathea zebrina* is a native of Brazil, and together with several species of *Maranta* are favourite exhibition plants.

Indian Shot (*Canna indica*). A well-known ornamental plant, said to be a native of India, but now indigenous to most tropical countries. It takes its name from the seeds being black and extremely hard, about the size of swan-shot.

There are many varieties which are very beautiful summer decorative plants, and much used in what is termed subtropical gardening. *Canna edulis* is cultivated in the West Indies, its fleshy rhizomes yielding a large quantity of starch, which is used for food known as "*Tous les mois.*"

The Plantain and Banana Family.

(Musaceæ.)

Simple palmids or long sheathing phyllocorms, sometimes cæspitose perennial-leaved rhizocorms. Leaves generally large, ovate-lanceolate, or linear elliptical, with sheathing footstalks and parallel veins diverging from the midrib. Inflorescence spathaceous; spathe persistent, with exserted, bisexual flowers; or deciduous, with male and female flowers in separate clusters, on a lengthening spadix. Fruit a 3-valved capsule; or succulent as in the Banana.

This beautiful and useful family is composed of 20 to 30 species, chiefly natives of the tropics. At the Cape of Good Hope the family is represented by the genus *Strelitzia.* The species of most importance to man are those producing the Plantain and Banana.

Plantain (*Musa paradisiaca*) and Banana (*M. sapientum*). These are generally supposed to be two distinct species, but their varieties seem to defy any botanical distinction; the spadix is erect, but more generally it is pendulous. As food plants they have been cultivated in all ages throughout the tropics, and are now so thoroughly universal, that it is extremely difficult to assign any place as their native habitat. They produces food for millions of people, far surpassing in quantity that of any other plant in proportion to the space it occupies. It has been calculated that the same area required to yield 33 lbs. of wheat, or 99 lbs. of potatoes, will produce 4400 lbs. of plantains.

The young fruit surrounds the flower-stalk or spadix in

Pl. 7.

a b c d e

clusters, and when ripe is of a yellow colour, the whole bunch weighing from 40 to 60 lbs., sometimes even more. Each fruit is from 6—8 inches long, and 4—5 inches in circumference. It is of a soft pulpy nature and agreeable flavour, being moreover highly nutritious. The Banana is eaten fresh when ripe, but the fruit of the Plantain is roasted, and eaten before it attains its full maturity.

In general the stems of Bananas rise 10—15 feet high, and are liable to be injured, or even destroyed by high winds. There is, however, a variety which has received the name of *Musa chinensis*, and is also cultivated in gardens under the name of *M. Cavendishii*, the stems of which are rarely more than 4—5 feet high, and very stout. This last variety has been successfully introduced into the Navigator's, Feejee, and other islands of the Pacific, and is much valued by the natives on account of its productiveness.

After fruiting the stems of these plants die down, but the root-stock continues to throw up other stems, which successively produce fruit. It is of easy cultivation in the hothouses of this country. After the fruit is cut the old stems are useful, as they contain a considerable quantity of fibre, and of late years machines have been invented, and sent out to the West Indies for the express purpose of cleaning the fibre. The most important species for this purpose—viz., producing fibre, is the *Musa textilis*, from which "Manilla Hemp" is obtained. This substance is extensively prepared in many parts of India, as well as in both the Malayan and Philippine islands, and is imported in considerable quantities to this country, and employed in rope-making, and for other purposes. Banana and Plantain leaves are used for many purposes in tropical countries.

Ensete (*Musa ensete*). This noble plant is a native of Abyssinia, and was originally discovered by Bruce, the distinguished traveller and collector, more than a century ago. His acccount of this plant, like many other parts of his history of that country, was doubted until 1853, when seeds

and a description of it were sent to the Royal Gardens by W. Plowden, Esq., then British Consul in that country. Plants raised from these seeds grew rapidly, soon attaining 8 feet in height, with a girth at 6 inches above the soil of 7 feet 6 inches, its leaves being 17 feet long by 3 feet 4 inches wide. This plant thus produces the largest *entire* leaf of any vegetable organism at present known. The flower-stalk rises from the centre of the plant as in the Banana, and is as thick as a man's arm, forming a considerable article of food to the natives. The fruit is not succulent, but small and dry, being quite useless as food.

Traveller's Tree (*Urania speciosa*). This noble plant, the "Traveller's Tree" of Madagascar, is also known as *Ravenala Madagascariensis*. It has a cylindrical stem, about 1 foot in diameter, and 30 or more feet in height. It has large leaves, like the *Musa ensete*, but set in two rows (distichous), and have their footstalks dilated at the base, and clasped round the stem. The flower-spike is short and produced from the centre, as in Musa. The fruit consists of a dry 3-valved capsule, and the seeds are the size of large peas, and are surrounded by a woolly coat of a beautiful blue colour (arillus). The stems harden, and are used in Madagascar for house-building, making durable floors for warehouses, &c., for this purpose they are split in halves, and the convex side is placed uppermost; this soon flattens down and becomes extremely hard.

The broad leaves of this plant are well adapted for collecting rain water, which trickles down the leafstalk and collects in considerable quantities within its sheathing base. If the bases of the leafstalks are pierced with a spear the water gushes out like a jet, and on this account it has received the appellation of "The Traveller's Tree."

A plant allied to the preceding in habit and mode of growth is *Strelitzia augusta*, a native of South Africa. It differs, however, in the stem being more slender, and it does not become so hard. In its native country it attains the height of 20 feet, but there, as also in cultivation, its weighty top causes

it to break over at that height. A plant at Kew being supported, formed a stem 34 feet high, and was still progressing when cut down in 1863. Its flowers are white, and small compared with the gigantic proportions of the plant. The seeds are like those of *Urania*, but have a red woolly covering instead of blue. The most beautiful flowering species is *S. Reginæ*, which has no stem, its leaves being borne on long footstalks that rise direct from the root. The flowers are of the richest orange and purple tints. This plant has long been cultivated at Kew, and derived its name in honour of the late Queen Charlotte, who was a Princess of Mecklenburg Strelitz. In the West Indies and tropical America the family is represented by many species of the genus *Heliconia*, which are of various sizes, the characters of their leaves being like those of *Musa*, and their flowers something like *Strelitzia*, being seated in large coloured bracts.

THE IRIS AND ORCHID ALLIANCE.

The Blood Root Family.

(HÆMODORACEÆ.)

Bulbo-corm or fibrous-rooted herbs, perennial phyllocorms, or woody-stemmed, branching shrubs. Leaves always set on the stem in two rows (*distichous*), grass or sword-like. Flowers solitary on a long footstalk, or in cymes, or panicles. Sepals and petals united, forming a tube, regular, or split on one side (as in *Anigosanthus*). Stamens 3—6. Pistil simple. Fruit a valved capsule, crowned with the withered perianth, sometimes nut-like, few or many seeded.

About 50 species constitute this family, all being widely distributed, their extremes of latitude being N. America and Australia. Their economic qualities are not many, but the red roots of some are used in dyeing. They contain a bitter principle, which is strongly marked in *Aletris farinosa*, a native of the United States, where it is known by the name of Colic-root.

The genus Vellozia consists of some remarkable plants, natives of Brazil, being stiff, much branched, screwpine-like plants, generally 2—3, and some even as much as 10 feet in height. They grow mostly in dry places, and when abundant give a peculiar feature to the locality.

The family is represented in the greenhouses of this country by several species of *Anigosanthus* and *Barbacenia*, the first natives of West Australia, and the latter of Brazil. Species of *Vellozia* have also been introduced, but their culture has not been very successful.

Allied to the preceding in general habit is the family *Hypoxidaceæ*, which are in general permanent phyllocorms, and consist of about 50 species, all widely distributed throughout tropical and subtropical regions. At the Cape of Good Hope they are strongly represented by the genus *Hypoxis*, and in India and the Mauritius by *Curculigo*. Their principle is bitter. Several species of the two latter genera are known in botanic gardens, all having pretty yellow flowers.

The Iris Family.

(Iridaceæ.)

Small branched palmids, or rhizo, or bulbo-corm herbs. Leaves grass-like, or sword-shaped, sheathing edgeways in two rows. Flowers solitary in spikes, racemes, or panicles, at first enclosed in a spath, or sheath-like bract, and generally highly coloured. Sepals and petals 3 each, equal or unequal, sometimes oblique, or two-lipped. Stamens 3, their bases more or less united. Pistil 1, the apex 3-parted, the lobes (stigmas) sometimes broad, petal-like. Fruit consisting of a 3-celled, 3-valved, many-seeded capsule.

About 500 species belong to this interesting family, their head-quarters being South Africa. In Europe they are represented by *Iris* and *Crocus;* in North America and China by *Sisyrinchium;* in tropical and South America by *Morœa;*

and in Australia and New Zealand by *Patersonia* and *Libertia*.

They are not very valuable in an economic point of view, except the rhizomes and tubers of some species being used locally in medicine; a few are eaten as food by the natives of South Africa, but they are of a drastic, purgative nature. All are favourites in gardens for their splendid flowers.

Orris-root (*Iris florentina*). A native of the South of Europe, and belongs to the group of Iris having thick fleshy rhizomes. It has white or pale blue flowers. The roots have the odour of violets, and furnish the well known Orris-root used in perfumery.

Fleur de Luce (*Iris germanica*). Indigenous to Germany and other parts of Europe. It is the common large blue Iris well known in gardens, and was an heraldic emblem in the arms of the Kings of France.

The Yellow Iris (*Iris Pseud-acorus*) and Gladwin or Roast-beef Plant (*I. fœtidissima*). Two beautiful species, natives of this country, growing in ditches and on the margins of ponds and streams. The seeds of the first are said to have been used as a substitute for coffee.

Corn Flag (*Gladiolus communis*). A native of the South of Europe, the more showy species of this genus being *G. cardinalis* and *G. natalensis* both from South Africa. Splendid hybrid varieties of these have been raised which are very attractive, and are highly prized by florists as ornaments for the flower garden.

Saffron (*Crocus sativus*). A species with blue flowers, native of Southern Europe and Western Asia. It has become wild in this country, and at one time was rather extensively cultivated at Saffron Walden. The yellow stigmas of the flower are collected, and form the dye known as "saffron." The principal quantity is imported from Spain and Barbary. The immense number of plants may be guessed at, it requiring the stigmas of upwards of 4000 flowers to produce a single ounce of saffron. It is well known as a valuable dye, and is also used for colouring cheese. Saffron is spoken

of by Pliny as being cultivated in Italy. The common Yellow Crocus (*C. luteus*) and Cloth of Gold Crocus* (*C. mœsiacus*), *C. susianus* and others, are well known spring flowering plants. The shrubby species of the family are represented in our greenhouses by *Witsenia corymbosa*, a native of the Cape of Good Hope, which when well grown forms a round bushy plant 2—3 feet high, having narrow sword-shaped leaves, growing on woolly branches. It resembles a miniature screwpine, and has panicles of pretty blue flowers.

The Orchid Family.

(ORCHIDACEÆ.)

Plants with special habits, and forms of flowers.

1. Hypogeous bulbo-corms of various forms, with soft flaccid annual leaves, and flower-stems (herbs). The whole of the British orchids are examples of this group.

2. Epigeous and epiphytal bulbo-corms (pseudobulbs), with 1, 2, or more firm biennial or perennial leaves (*Lycaste*, *Peristeria*, *Cattleya*, *Odontoglossum*, *Stanhopea*, &c.).

3. Epigeous or epiphytal, generally cæspitose, perennial phyllocorms (*Neottia speciosa*, *N. elata*, *Calanthe*, *Cymbidium*, *Cypripedium venustum*, and allies).

4. Fruticuls, epiphytes with distant or contiguous (distichous) leaves successively developed from the apex, of a continuous progressing stem (as in palmids): (*Aërides*, *Vandas*, some *Angrœcums*, and *Vanillas*.)

These represent the principal forms of orchid stems; but there are many special forms, such as the reed-like stems of *Sobralia*; the rod and cord-like stems of *Dendrobium calceolaria*, *D. Pierardii* and allies, which do not well associate with the above, and seem to be characteristic of distinct groups.†

In *Phalœnopsis*, *Oncidium luridum*, *O. Ceboletta*, and

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* The Song of Solomon, chap. iv. ver. 14. † Page 14.

others, the corm is absent or rudimentary only; in the one-leaved genus *Pleurothallus* and its allies, it is more or less linear cylindrical, and has the appearance of being the foot-stalk of the leaf; while in *Grammatophyllum* it is stout and cane-like, attaining the height of 5—6 feet, being the largest orchid corm known.

In all the leaves are simple, entire, glabrous, rarely pubescent; varying in form from cylindrical (spike or rush-like) to broad elliptical and subrotund, rarely absent. Flowers solitary, in spikes or racemes, rarely in umbels or panicles, each flower consisting of 3 sepals and 3 petals of various size and form (often grotesque), one always representing a labellum (Fig. 4 *b*), which is plain, cucullate, pitcher-shaped, or divided into a fine hair-like fringe (moveable in some when touched). Stamens normally 3 (generally the two lateral ones abortive, or, as in *Cypripedium* the central one abortive), and with a pistil consolidated, forming a gynandrous column, bearing on its apex a deciduous operculum, under which lies 2—8 free masses of generally waxy pollen, attached to a viscid gland seated in front of the column, two in *Habenaria* and *Bonatea*, being either sessile with the pollen masses, or furnished with a thread or strap-like appendage (caudicula). Stigma generally in the form of a viscid cavity in front of the column, or consisting of two projecting lobes, as in *Bonatea*. Fruit a 3-sided, 3-valved capsule, containing numerous membranous very small seeds.

The late Dr. Lindley, who was a great authority on this family, gives in his "Vegetable Kingdom," 3000 as the number of species. They are found in nearly all parts of the world, those existing in cooler regions having bulbous roots or rhizomes, and grow on the earth, many such being also found in the tropics, but a great majority of the tropical species grow upon trees.

It is surprising, when we consider the immense number of species and the superlative beauty of many of their flowers, that the family should possess but few economic uses. They have, however, come into great repute within the last forty

years as ornamental garden plants, and about 100 of the most showy species belonging to the genera *Cattleya*, *Odontoglossum*, *Lycaste*, *Stanhopea*, and others of the Western hemisphere, and *Aërides*, *Vanda*, *Saccolabium*, *Dendrobium*, and *Phalænopsis* from the Eastern hemisphere, are well known at horticultural exhibitions. A few of small growth are valued for the beauty of their leaves. Such as several species of *Anœctochilus*, their colour being of a brownish hue and velvety texture, some being striped with white, while *A. setaceus*, a native of Ceylon, called "King of the Woods," is netted with gold, as is also the rare *Stelis calodictyon*, a native of the Andean regions of Peru. *Hœmaria discolor*, *Cypripedium venustum*, and allies, have also brown or variously coloured leaves, silvery leaves being represented by *Physurus argenteus*, a native of Brazil. High prices have been paid for some of the more showy species, even as much as 90*l.* for a single plant, and special collectors have been sent abroad in order to collect, and transmit them to this country.

The interest taken in the cultivation of exotic orchids is also shown by the number introduced. In 1825 the Kew collection did not exceed 50 species; in 1854 they had increased to above 850, but during that period and for ten years later it was surpassed by the collection of the late Messrs. Loddiges in their long celebrated nursery at Hackney, now a thing of the past. The principal collections are now to be found in France, Belgium, and Germany. The catalogue of a private collection at Hamburg, published a few years ago, contains the names of above 1350 species. In all such collections many are of mean appearance, and often with small insignificant flowers, but of singular forms, and appreciated by their possessors as botanical curiosities. Since the dispersion of the Hackney collection and the fashionable patronage of late years of the cultivation of show flowers, many orchids of botanical curiosity have disappeared from the collections of this country.

In this country the family is represented by about 40 species, which are also common to Europe, consisting of

perennial plants with fleshy bulb-like roots, and generally found in moist meadows, pastures, the margins and open parts of woods; some species grow in chalky soils; the greater number are found in the southern counties, but specimen collectors and hawkers are fast hastening their extinction. Many species have very peculiar flowers, being in the form of insects, as bees, flies, &c.: the Bee Orchis (*Ophrys apifera*); Fly Orchis (*O. muscifera*); Spider Orchis (*O. aranifera*); Lizard Orchis (*Orchis hircina*); Man Orchis (*Aceras anthropophora*). The tropical species also present very singular and curious forms, as the Butterfly Orchid (*Oncidium Papilio*); Night Moth Plant (*Phalænopsis amabilis*); Dove Plant, "El Spirito Santo," or Holy Ghost Plant, of the Peruvians (*Peristeria elata*), and many others too numerous to mention here. (See page 45.)

Vanilla (*Vanilla planifolia*). An epiphytal plant growing like ivy, with thick laurel-like leaves, a native of the West Indies and tropical America. It has insignificant greenish flowers, and produces a pod-like fruit 5—10 inches long, and 1 inch in circumference, which is well known for its grateful aromatic qualities, and its uses in confections, perfumery, and medicine. In commerce, it is, in proportion to bulk, the highest priced vegetable production imported. The greatest importation to this country is from the eastern parts of Mexico. It is now cultivated in Guiana, and other parts of tropical America, as also in Ceylon, India, and other parts of the East.

Salep. *Orchis mascula*, *O. Morio*, *O. militaris*, *O. pyramidalis*, and all the bulbous European species, produce the starchy-mucilaginous substance commonly known as "salep," which is obtained by macerating the bulbs in water. It contains a chemical substance called bassorine, which is said to contain more nutritive matter than any other vegetable product, one ounce per diem being sufficient to sustain a man. Large quantities of "salep" are prepared in Macedonia and Greece, but the finest comes from Turkey. In the Himalaya and Cashmere many species of bulbous-

rooted orchids yield salep, which is largely used as food by the natives.

Rock Lily (*Dendrobium speciosum*). A native of New South Wales, growing upon rocks. It has large pseudo-bulbs, the size of cucumbers, which are said to be eaten by the natives. It has a long spike of white showy flowers. New South Wales contains a large number of terrestrial species, all of which are both beautiful and interesting.

With regard to the fertilization of the ovary of orchids early botanists entertained two different opinions; one that the fertilizing essence of the pollen passed through the caudicula and gland to the stigma; the other that the pollen came in direct contact with the stigma, as is the case in ordinary flowers. After many experiments carried on for several years on plants under my notice at Kew by the "Prince of Botanists," Dr. Robert Brown, he in 1833 published the result of his observations, proving the latter to be the correct view, the principles of which I have briefly explained at page 32. But with regard to orchids it is necessary to explain the important part performed by the gland; in general its size and form may be compared to a small teat or pin-head, which on being touched by the finger, pencil-point, or the like, it adheres, and on moving the hand the attached pollen-masses are drawn out from under the operculum. On applying a pollen-mass to the moist surface of the stigma it immediately adheres and becomes absorbed. Soon after this, the aspect of the flower changes; the splendid flowers of *Cattleyas* begin to fade the following day; others change colour, and in some the parts of the flower increase in size; but the most important effect is that produced on the ovary, which gradually increases in size, and in time becomes a capsule with perfect seeds. With very few exceptions the fertilization of orchids does not take place without artificial aid; in nature the chief operators being insects, by the gland adhering to their bodies, and with the pollen-masses are conveyed from flower to flower, and by the movement of the insect in the flower the pollen thus comes in contact with the stigmas. In

the genus *Catasetum* the caudicle is in the form of a strap, which is highly elastic; on being touched, or the parts of the flower disturbed, it springs out with a degree of force to the distance of a foot or more, carrying with it the pollen and gland, the latter adhering to whatever surface it strikes against; instances are known of its striking the face, causing dismay to unwary observers.

The labellum of some species is attached as it were by a fine hinge, the least motion causing it to vibrate. In *Bolbophyllum barbigerum* it consists of a tuft of brown, nearly erect hairs, like a little brush, the least motion of the air causing it to bend down, but quickly regaining its position, giving the idea of nodding or bowing, and it does this by the motion of the breath in speaking at a yard or more distant, and many have been deceived by the idea that it was voluntarily bowing to them. This motion is, however, only mechanical, and quite different from the sensitive motion of the lip of *Pterostylis*.

I have now stated sufficient to show the curiosity of orchids, which will be found verified on reading Mr. Darwin's book lately published on the "Fertilization of Orchids."

A family very nearly related to the orchids, is Apostasiaceæ—a group of perennial plants of which there are said to be 5 species, natives of India.

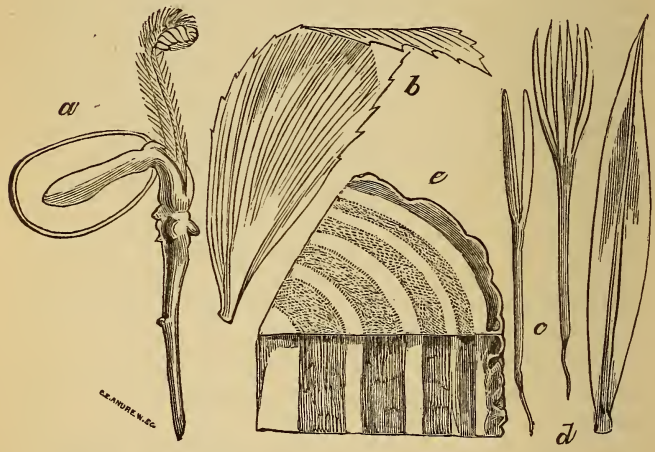
Another family, Burmanniaceæ, consists of about 30 species, being small perennial plants, natives of the tropical parts of both hemispheres.

Also we may here notice a small group of curious plants —Triuridaceæ, consisting of about 8 species, natives of Brazil, Ceylon, and Java. They are small translucent perennial plants, with simple, erect stems and pale leaves, destitute of nerves. Flowers minute, on spikes or racemes. They are only interesting botanically. Botanists entertain different views of their relationship; some place them with *Burmannia*, which is also of doubtful affinity.

CLASS IV.—GYMNOSPERMS. (*Gymnogens. Lindley.*)

Seed a naked ovule; embryo with one cotyledon (Cycads) or two or more (Conifers). Leaves free veined. Stems endogenous (Cycads) or exogenous (Conifers).

FIG. 13.



a. Germinating Zamia; *b.* Leaf of ditto; *c.* Germinating Coniferæ; *d.* Leaf of ditto; *e.* Section of stem of Cycas.

The mode of fertilization and nature of the seeds (fruit) of the plants in this family is of a special character. The flowers so called are unisexual, and destitute of calyx and corolla; the male consists of sessile anthers, seated on the scales of cones or catkins, the female being represented by an ovule only, destitute of ovary, style, and stigma; fertilization being effected by the pollen coming in direct contact with the apex of the naked ovule, which in time becomes an albuminous nut-seed, destitute of a true seed coat.

They are either produced solitary, as in the Yew, or few or many in cones, as in Firs, or in globose, or horned galbules, as in the Evergreen Cypress, and Arbor Vitæ.

This class comprises the Cycas, Fir, and Yew families, their special bond of union consisting in their seed ovules being destitute of a coat or covering (thus differing from the usual structure of seeds). They are classed by most botanists under Exogens, and which is the proper place for the two latter families. But having witnessed the germination of many seeds of Cycads, it enables me to say that the embryo has only one cotyledon, and also that the structure of the stem is endogenous, as in Palms. Such being the case, gymnogens may be considered to form two natural sub-classes. First, *gymnospermous-endogens*, the Cycas family; second, *gymnospermous-exogens*, the Fir and Yew family.

I. Gymnospermous Endogens.

The Cycas Family.

(Cycadaceæ.)

Stem globose or cylindrical (Palmids), unbranched (rarely forked), their substance composed of three or more concentric zones of firm pith, alternating with a narrow zone of woody fibre, the outer consisting of the bases of the fallen leaves, which represent bark, the lateral extension being very limited. Leaves, few or many, terminal; simply, or rarely twice-winged; generally very rigid, with or without a midrib, and with free veins. Fructification in terminal dicœcious cones, formed of fleshy scales. Seed a naked ovule, being a waxy or horny albuminous nut, the embryo germinating with one cotyledon (fig. 13, *a*).

This remarkable family of plants consists of about 50 species, all being widely distributed within or near the

tropics of Asia, Africa, America, and Australia. The stems of the whole species consist of a pithy matter containing starch.

Cycas revoluta. Supposed to be a native of China and Japan, but also found in a wild state in New Guinea, and many of the islands of the Pacific. It has become naturalized in the West Indies, and has been long introduced to this country, being highly prized as an ornamental plant, often having a stem 3—4 feet in height, and from 6—8 inches in diameter. In China and Japan, and also in Jamaica, a kind of sago is obtained from the pith of the stem.

Cycas circinalis. This is abundant in Malabar and many parts of India, as well as in the Malay, Molucca, and other islands. It is a taller growing species than the preceding, having a trunk about 6 inches in diameter, which attains the height of about 20 feet, and is sometimes forked. A kind of sago is obtained from its stem, and in New Ireland and other islands the natives make use of the large nutty seeds for food.

Caffre Bread (*Zamia*) (*Encephalartos*) (*Caffre* or *E. longifolius*). A native of South Africa, attaining the height of 10—15 feet, with a diameter of about a foot. The substance of the stem is mucilaginous, and the natives bury it in the ground for a time, which causes the pulpy centre to loosen and partially ferment; it is then dried, baked, and used as food by the Caffres. It is, with other allied species of slow growth, like palms taking many years before the normal diameter of the stem is formed. The leaves are produced annually in a fascicle of about 20; the circle formed by the bases of the leaves of each succeeding fascicle being closely seated on the preceding one, consequently the yearly increase of the stem is limited to the vertical diameter of the base of the leaf, which in this species is about $\frac{3}{4}$ of an inch.

In 1775 a plant of this species was introduced to Kew, but its size at that time is not known; in 1822 it was considered a remarkable plant, being then a foot in height, with a crown of leaves forming a diameter of about 8 feet; it is

c
b
a
d
e

now (1870) 4 feet high, with a girth of 3 feet 11 inches; thus growing 3 feet in 48 years, which gives $\frac{3}{4}$ of an inch yearly. It has several times produced male cones 2 feet in length.

Zamia (*Macrozamia*) *Denisoniana.* A native of New South Wales. Although originally known as a low plant, it has been seen in the Richmond River district 30 or 40 feet high; according to the observed rate of growth, such plants cannot be less than five hundred years of age. It has long slender leaves, like palms, which are used in Roman Catholic churches in Australia on Palm Sunday. An allied species, *M. Fraseri*, is found in Western Australia; it has a thick trunk, often 8 or 10 feet high. Several remarkable species have lately been discovered in Queensland, one 60 feet in height.* About the year 1802, during Captain Flinders' voyage, a leaf of a plant was gathered at Rockingham Bay which puzzled the most eminent botanists, up to the rediscovery of the plant, in 1862, by Mr. Walter Hill, who sent specimens and living plants of it to Kew. It differs from all the rest of the family in having leaves twice-winged (bipinnate), very much resembling some species of the Fern genus *Marattia;* it has proved to be a new genus, and has received the name of *Bowenia spectabilis.* There are several species of the family found in Mexico and Central America, but none extending south of the equator.

Dion edule, a native of Mexico, is a curious plant, old plants of it having stems 3—4 feet high, with leaves of equal length, in which the pinnæ are set very close, even imbricate, and being very hard and stiff, and of a bluish colour, give the feeling and appearance of metal. Its seeds are eaten.

Ceratozamia is another genus of the family, chiefly differing by the scales of the cone being two-horned, and the footstalks of the leaves prickly, as in *C. Mexicana.*

Zamia integrifolia and *Z. furfuracea.* The first, native of

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* Authority, Mr. Walter Hill, director of the Brisbane Botanic Garden.

East Florida, and the latter of the Bahamas, and other small West India islands, where it grows in abundance. It yields sago, which is much used in Jamaica.

Stangeria paradoxa. A remarkable plant, native of Natal. It has a fleshy obconical stem, 6 or more inches in height (according to age), and about 3 or 4 inches in diameter, from the top of which are produced winged leaves, one at a time, 2 to 3 feet in length, the pinnæ being lanceolate, having a midrib with divergent veins like many Ferns, being in some respects similar to *Lomaria*, in which genus it was first placed by an eminent botanist, under the name of *L. eriopus;* but its fructification being found in cones proved it to belong to Cycads. Hitherto fossil Cycads were distinguished from fossil Ferns by their veins being always longitudinal and parallel without a midrib, but *Stangeria* having a midrib and divergent veins, destroys that distinguishing character.

Fossil remains of this class of plants are abundantly found in the Isle of Portland, Yorkshire, North of Scotland, France, Russia, India, and China; but it is singular that none have yet been found in Australia or South Africa, where they exist in a living state, as above shown, and with those of America may be viewed as the living representatives of the fossils called *Lepidodendron*, *Sigillaria*, *Calamites*, &c., which at some remote period must have formed a peculiar feature in the flora of the earth.

Sub-Class 2. Gymnospermous Exogens. Fig. 13, *c*.

This comprehends all the trees and shrubs known as Coniferæ (cone-bearing), of which there are about 200 species known, the difference in their fructification being considered sufficient to give character to three families—viz., Pinaceæ, Taxaceæ, and Gnetaceæ.

Although their branched character as Exogenous trees differs widely from that of Cycads, they nevertheless possess points of relationship besides that of the naked ovule. In most of the cone-bearing genera their branches are annually

produced in a whorl; the distance between the whorls being the growth of each year, in that respect analogous to the increase in the stem of Cycads consequent on the annual development of a whorl of leaves, as explained in the Cycads; the leaves of which being long permanent may be viewed as partaking of the nature of branches. The leaves of the genus *Pinus*, *Araucaria*, and others, agree with those of *Cycas* in having a midrib only; while the broad leaves of *Dammara* have longitudinal veins without a midrib, and thus coinciding with *Zamia Skinneri* and other American species. The structure of the wood of Coniferæ differs from that of other trees (Magnolia excepted) in the tissue containing numerous circular clear dots arranged in lines, which may be seen by placing a thin shaving from any kind of fir-wood on glass, moistened with water, and viewed under the microscope.

With the exception of food-producing families, Coniferæ may be viewed as the next in importance to man in many countries. They are not only valued for their timber, but also for their products of tar, pitch, and turpentine. In this country the timber known as pine, fir, and spruce is the principal wood employed in house and shipbuilding and erections of all kinds; also for making implements, and many articles of domestic economy, even lucifer-matches. Under certain conditions coniferous wood appears to be indestructible; in the north of Scotland trees are found imbedded in peat bogs; their resinous nature and the antiseptic property of the peat preserves them from decay. They are split into laths, and used as candles, the resin they contain causing them to burn with a steady flame. The hard resinous knots common to fir timber are formed by the bases of the dead branches becoming imbedded in the body of the tree.

The numerous piles lately discovered in the Swiss lakes are found to be coniferous wood, and being pre-historic must be viewed as the oldest remains known of the work of man on wood (page 120).

The Fir and Cypress Family.

Shrubs, small or large trees, many with their branches whorled. Leaves perennial, rarely annual, solitary, or two or more in a fascicle, of firm texture and sharp-pointed, with a midrib only, or with longitudinal parallel veins without a midrib. In form they are acerose, subulate (needle or awl-like), rusciform, lanceolate or broad elliptical, or small, scale-like and imbricate, forming thyclads (p. 24). Flowers monœcious or diœcious. Fruit a cone or galbulus (in Juniperus berry-like), containing naked or winged seeds. A balsamic fragrance pervades the whole family.

Sectional view of the principal genera represented by species growing in this country.

Seed in Cones.

Leaves with a midrib only.

Leaves two or more in a fascicle.

Pinus and Larix.

Leaves free, distinct.

Abies, Picea, Araucaria, Cedrus.

Cunninghamia.

Leaves destitute of a midrib.

Dammara.

Seeds in Galbules, in some cone-like.

Leaves small subulate distinct, closely imbricated, often scale-like.

Sequoia (Wellingtonia) Cryptomeria.

Sciadopitys, Libocedrus, Thuja, Fitzroya.

Saxe Gothæa, Cupressus, Callitris.

Thujopsis, Arthrotaxis, Microcachrys.

Juniperus, Retinospora, Widdringtonia.

Taxodium, Glyptostrobus. The leaves of the two latter genera are annual.

On account of numerous discoveries of late years the number of species in this family probably reaches 200, about 100 of which belong to the genus *Pinus*. They are widely

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distributed over the earth; the greatest portion being found in temperate regions, extending to the utmost limit of tree life in the north polar regions; they are also found in warm climates.

Pine forests form a grand feature in the northern hemisphere, while Araucarias and Dammars take their place in the southern. In the Andean region of Mexico a number of species of *Pinus*, along with oaks, form extensive forests extending north through California and North-west America, where very large trees are met with. They are all of a highly resinous nature; their timber and other products form great articles of commerce. It would occupy too much space to give details of the whole, but the following are the most important.

Scotch Fir (*Pinus sylvestris*). This well known tree has an extensive range throughout Europe and Northern Asia, where it forms large forests, such as may be seen in the north of Scotland, some trees attaining the height of 100 feet, and affording excellent timber, which is imported from the ports in the Baltic under the name of Riga and Norway timber. The smaller trees are used for scaffold poles. It also yields tar.

The word fir is frequently named with cedar and other trees, which Solomon obtained from Lebanon for the building of the Temple. One of these was doubtless *Pinus halepensis*, which takes the place in Lebanon and other mountains of Palestine of the Scotch fir, and may be admitted to be the fir-tree, instead of cedar used for ship-masts, as stated in Ezekiel, chap. xxvii. ver. 5.

Pitch Pine (*Pinus palustris*, or *P. australis*). A native of the Southern United States, where it covers extensive tracts, making its appearance in all waste places and quickly occupying worn out cotton fields. This and the Scotch fir afford the largest quantity of tar and turpentine of commerce. The former is obtained in the following manner by what is termed distillation; the boles, roots, branches, and waste timber are cut up into billets; a conical

hole is dug in the ground, generally in the side of a bank, in which the billets are placed and formed into a heap above the surface, the whole being closely and compactly covered with turf or earth, a fire is then kindled from below and the slow combustion causes the tar to exude from the wood, and flow from an opening into barrels placed below to receive it. The greatest quantities used in this country are imported from the United States, from ports in the Baltic, and Archangel. Tar by distillation yields the products wood vinegar (pyroligneous acid), oil of tar, and creosote, and leaves a resinous residue called common pitch; the principal quantity of pitch, however, is obtained by boiling tar; by evaporation the volatile oil passes off, and it hardens.

The above method of obtaining tar and pitch was described by Theophrastus 2200 years ago. Turpentine is the fluid juice of fir trees, which flows freely when wounds are made in the bark. It is composed of volatile oil and resin, and hence is termed oleo-resin, but by distillation their component parts are separated; the former constitutes what is called oil of turpentine, and the latter the well known resin. The greatest quantity of turpentine used in this country is imported from America.

Pinus Pinaster, *P. Laricio* and *P. maritima.* All natives of Southern Europe. They are planted on the low shore in the West of Ireland, Normandy, and other places for fixing the sands, where they form a thick low bush, but in favourable situations they attain the size of lofty trees. The first-named produces Bordeaux turpentine.

Stone Pine (*Pinus Pinea*). A low bushy tree, native of the South of Europe, growing freely in this country. The seeds are large and nutty, and are eaten. There are many Pinuses of value in their native countries for their timber, such as *P. Lambertiana*, *P. Coulterii*, *P. Sabiniana*, *P. macrocarpa*, and *P. ponderosa*, all large trees of California and North West America. Their nutty seeds form the principal

winter food of tribes of Indians, and even the bark of some is eaten. They are all hardy in this country, as also *P. excelsa* of the Himalayas, the latter being the same as *P. peuce* found in Macedonia.

All the above species belong to the true pine and fir group, and are known by having from two to five needle-like leaves in a sheath, thus distinguishing them from the spruce group.

Spruce Fir (*Abies excelsa*). A native of the Northern and Alpine regions of Europe, and is said to attain the height of from 100 to 150 feet. It grows freely in this country, and when standing singly forms a beautiful tree equal to the Araucaria of Norfolk Island. It has drooping cones six inches in length, the scales of which are permanent. It is valued for its timber, which is imported from ports of the Baltic under the name of white deal; it furnishes a resin from which true Burgundy pitch is made. A kind of frankincense is also obtained from it, and the young branches are boiled for making spruce beer. It extends to the regions of the icy sea in 70° north latitude, where trees of no great size have been cut down showing 300 annual rings, consequently that number of years old. *Pinus Cembra* has been found in the same locality having an equal number of rings.

Abies Douglasii. An immense tree of this group, native of North West America, where it is said to attain the height of 200 or more feet; its wood is soft and brittle. A specimen, called the flag-staff, has been erected at Kew, measuring 159 feet in height.

Silver Fir (*Picea pectinata*). A native of Europe and Northern Asia. It takes its name from its silvery white leaves, and attains a great height, it is even said above 200 feet, and when standing singly is a beautiful tree. A resin is obtained from it, which when purified, is called Strasburgh turpentine.

Picea balsamea. A native of Canada and other parts of

North America. Its leaves are silvery-white on the underside; the cones yield a turpentine called Canada balsam, which is used for preserving microscopic objects.

There are many noble species of *Picea* natives of California, such as *P. nobilis*, *P. Menziesii*, *P. bracteata;* also the beautiful *P. Webbiana* of North India, but the latter is, unfortunately, not hardy in this country. *P. Cephalonica* and *P. Pinsapo*, natives of the South of Europe, form beautiful ornamental trees in this country.

Abies and *Picea* are distinguished from *Pinus* by their leaves not being in sheaths; and *Abies* and *Picea* differ in the cones of the first being pendulous and the scales permanent, while in *Picea* the cones are erect and the scales deciduous, leaving the centre axis standing like a spike.

Larch (*Larix europœa*). The larch forms large forests in Switzerland and other parts of Europe, and is extensively planted in this country for its timber. It forms an ornamental tree sometimes attaining a great height, and is the only European species of the family that sheds its leaves. In Scotland (Perthshire) trees are to be found measuring 21 feet in circumference.

Larix Kœmpferi. A native of China, is in habit similar to the European larix, but with a more glaucous hue in the leaves, and is called the Golden Larch. It is described by Mr. Fortune as attaining the height of 120 to 130 feet, with a clear stem of 50 feet and a girth of 5 feet near the ground. It was introduced about fifteen years ago, grows freely and appears quite hardy. It yields Venice Turpentine.

Cedar of Lebanon (*Cedrus Libani*). A native of Western Asia, the earliest and best known being those of Mount Lebanon; it is also found on Mount Taurus and other mountain ranges of Asia Minor. The cedar is of ancient fame, and is first brought especially into notice by King Solomon sending to Hiram,* King of Tyre, for cedar trees to build

* 1 Kings, chap. v. ver. 2.

his Temple with. But it is doubtful if the word cedar was not also applied to other trees, and which is probably the case, as abundance of fine oak and other timber was more conveniently obtained in the vicinity of Mount Lebanon, than in getting cedar trees through the difficult passes from the cedar regions which, according to modern measurement, is an elevated plain of 6172 feet above the level of the sea. The area now occupied does not exceed a quarter of a mile in diameter, on which grow in nine groups, about 400 trees. They vary from 18 inches to 14 feet in diameter, and the oldest is supposed to be two thousand five hundred years old, which, if correct, proves that none of these trees were growing in the time of Solomon. The cedar was introduced to this country not more than two hundred years ago; the once fine trees in the vicinity of the Pagoda at Kew being about one hundred and twenty years old. In this country its timber is not in much repute.

Deodar (*Cedrus Deodara*). A native of the Himalayan mountains, where it forms large forests, some trees attaining the height of 100 feet. Its timber is much valued and used in India. It was introduced to this country in 1831. When young it grows freely, but is liable to suffer in severe winters, and it is probable it will never equal the Cedar of Lebanon as an ornamental tree in this country.

Atlas Cedar (*Cedrus Atlantica*). A native of the Atlas mountains in Algeria. It attains a large size, and has been introduced to this country; the leaves are longer than the Deodar or Cedar, and it is of faster growth. Some writers consider this and the two preceding as only varieties of one species, but whether they are from one original, and their present apparent distinctions consequent on climate, it is impossible to ascertain.

Cryptomeria Japonica. A lofty evergreen tree, native of Japan and North China, where its timber is used for many purposes. It was introduced in 1843, and being hardy, a free grower, and of graceful habit, forms an ornamental tree.

Kauri Pine (*Dammara australis*). A noble tree, native of New Zealand, where it attains the height of 200 feet, and as the stems of old trees are perfectly clean and free of branches for a considerable height, they are greatly valued, and are imported as spars for ships of war. A great quantity of clear resin, like copal, flows from it, which is imported to this country for varnish making.

Dammar Pine (*Dammara orientalis*). A large tree of Amboyna in the Molucca Islands. It yields the fine resin called Dammar. Three or more species of a like nature are found in New Caledonia, New Hebrides, Fiji, and also in Queensland, examples of which, with the two preceding, may be seen at Kew.

Chili Pine (*Araucaria imbricata*). A native of the Andean range of Chili, where it attains a great height, and forms large forests. This remarkable plant was first introduced in 1794, living plants having been brought home by Archibald Menzies, surgeon and botanist in Vancouver's voyage of survey. At a dinner given by the Viceroy of Chili to the officers of the ship, part of the dessert consisted of some kind of nuts, which being strange to Menzies, he took some of them on board the ship and sowed them in a box of earth, where they vegetated, and five plants were safely brought to England. One of these plants is still growing at Kew, another at Windsor Castle, and a third at Dropmore, the latter having outgrown the other two, and is now a fine tree 50 feet high. In many parts of the country some trees have been injured and others quite killed by the severe frosts of 1867 ; but the Dropmore tree is uninjured. *A. brasiliensis* is a native of the Organ mountains of Brazil, and has the general appearance of the above, but its leaves are less in size and not so closely imbricated; and altogether it is apparently a more slender tree, and not hardy in this country.

Norfolk Island Pine (*Araucaria excelsa*). A native of Norfolk Island, and attains the height of above 200 feet. Two closely allied species, *A. Cookii* and *A. Rulei*, are immense trees, natives of New Caledonia ; *A. Cunninghami* and *A.*

Bidwilli are natives of Queensland, the latter being called "Bunya Bunya," and the natives periodically visit the forests for the purpose of eating the nuts. They are all valuable timber trees, but tender in this country. Fine specimens may, however, be seen at Kew, two of *A. excelsa* being introduced in 1793, and now form ornamental trees in the conservatory.

Redwood (*Sequoia sempervirens*). A native of California, attaining the height of more than 300 feet. It has been introduced to this country and found perfectly hardy, some specimens being from 30 to 40 feet high, forming fine ornamental trees.

Mammoth Tree (*Sequoia gigantea*). This was supposed to be a distinct genus from *Sequoia*, and on account of its large size English botanists named it after the great warrior, the Duke of Wellington, thus giving it the name of *Wellingtonia gigantea*. Careful examination has, however, shown me that it is in no way distinct as a genus from *Sequoia*. It is a native of California, and for some time was thought only to grow in one locality, called the Mammoth grove; it has, however, been found in several other mountain ranges, but not equal to the size first discovered. Its immense size was well known to visitors to the Crystal Palace, by a portion of the thick bark of one of the trees being set up in the position it occupied when growing, showing its natural dimensions; the height of the tree felled being 327 feet, and 30 feet in diameter at the ground.* The wood is soft and not durable. It grows freely and fast in this country, forming as yet a very ornamental tree, some having already attained the height of 30 feet.

Deciduous Cypress (*Taxodium distichum*). A tree of considerable size, native of the Southern United States, having horizontal branches, and small flat leaves set in two rows (distichous), and are deciduous; it is perfectly hardy in this country, attaining the height of 50 or more feet. Its heart

* Destroyed by fire in 1867.

wood is of a beautiful pink red colour, but soft. It is remarkable for the hollow excrescences produced by the roots at a considerable distance from the tree, which rise to the height of 2 or 3 feet; they are used for many domestic purposes in its native country.

One of the few rare trees left in the original arboretum ground at Kew is a species of Cypress planted one hundred years ago by the first Aiton, who considered it a variety of *C. disticha*, but the time of its introduction and native country is not specially recorded. During the last fifty years it has been known by the name of *Cupressus*, or *Taxodium pendula;* it is now about 35 feet high, with a girth of 2 feet, and in general habit resembles *C. disticha*—more slender in growth, with drooping branchlets and longer leaflets, not distichous. A few years ago it flowered, which enabled it to be identified as a native of China, and has been characterized by the botanist Endlicher as a distinct genus—*Glyptostrobus* (*G. pendula*). A species described as growing in the vicinity of Canton, which may be considered as the locality from which the Kew plant came, and probably the same species, but which does not appear to have been again reintroduced.

Evergreen Cypress (*Cupressus sempervirens*). A native of Western Asia. It has long been cultivated in this country and throughout the southern parts of Europe. It is much planted about Mohammedan burial-grounds, as may be seen in the neighbourhood of Constantinople. It attains the height of from 40 to 60 feet, but in this country seldom reaches 20, and maintains a compact pyramidal form. Some Bible commentators suppose it to be the "Gopher wood" of which Noah was commanded to build the ark. But there is no evidence to prove this as being the tree. It grows on Mount Lebanon, and is probably one of the trees spoken of as "cedar" in Solomon's time.

Cedar of Goa (*Cupressus Lusitanica*). Said to be a native of the Western Peninsula of India, and introduced by the Portuguese from Goa to Portugal, where it forms natural

forests; it is not sufficiently hardy to stand the winters of this country. Allied to these is *C. macrocarpa*, a large tree, native of California, and up to 1867 supposed to be hardy, but the severity of that winter destroyed nearly all the plants in the country, the original ones being nearly thirty years old.

Funeral Cypress (*Cupressus funebris*). A remarkable tree, native of China, having pendulous branches like the weeping willow. It has been introduced, but is not found to be quite hardy.

Arbor Vitæ (*Thuja occidentalis*), a native of North America, and *T. orientalis* of China, are with us well known ornamental low bushy trees, and with other species in their respective countries form gigantic trees, such as *Libocedrus chilensis* and *L. tetragona*, fine timber trees, natives of Chili, and represented in New Zealand by *L. Doniana*. These have been introduced to this country, but are not sufficiently hardy to live in the open air.

Sandarach (*Callitris quadrivalvis*, also known as *Thuja articulata*). A small tree, native of Algeria and other parts of North Africa. It seldom exceeds the height of thirty feet, and has hard dark-coloured fragrant wood that takes a fine polish, and is used in ornamental cabinet work, of which there are fine specimens to be seen in the Museum at Kew. It was highly prized by the Greeks and Romans, and is believed to be the "thyine wood" mentioned in the Revelation,* which, if so, "the merchants of the earth" must have carried it as far as Babylon. It produces a very odoriferous resin, which is used for varnishing.

Juniper (*Juniperus communis*). A low bushy shrub found growing in uncultivated heathy and rocky places throughout Europe. Its berries are used for flavouring gin.

Pencil Cedar (*Juniperus Bermudiana*). A native of the island of Bermuda, forming a small tree or bush. It is generally understood that this is the black-lead pencil wood,

* Chap. xviii. ver. 12.

but red cedar (*Juniperus Virginiana*) is also used for that purpose. The first is not hardy in this country, the latter is.

Juniperus Sabina, *J. Phœnicia*, and *J. oxycedrus*. Natives of Syria and Palestine, and as they are all resinous and aromatic, there can be little doubt that one of them is the "cedar wood"* ordered to be used by the Israelites in their sacrifices in the wilderness, cedars of Lebanon being at that time to them unknown. The word juniper occurs three times in the Bible, but it does not belong to this family (see Broom). *Juniperus Sabina* is admitted into the London Pharmacopœia as a medical plant. It is of a poisonous nature.

The Yew Family.

(TAXACEÆ.)

Shrubs, or trees, some with their branches in whorls. Leaves perennial, firm, acerose, subulate, linear or elliptic-lanceolate, smooth, with a midrib only, or with longitudinal veins. Flowers monœcious or diœcious. Males in spiked catkins; female solitary, peduncle thick and fleshy, bearing a naked ovule, which becomes a nut seed. (*Phyllocladus* and *Salisburia* are exceptions, which see.)

This family consists of about 150 species, all widely distributed over the temperate and warm regions. They are useful for timber.

Yew (*Taxus baccata*). A native of the temperate regions of Europe and Asia. It is famed for its age and the durability of its wood, remains having been found in the ruins of ancient Nineveh. It is much planted as an ornamental tree, and is also used in forming hedges.

The berries are not actually poisonous, and although not of very agreeable taste are sometimes eaten by children; in winter they form a great supply of food to the feathered

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* Leviticus, chap. xiv. ver. 4.

tribe. The branches and leaves are in a high degree poisonous to horses and horned cattle, and act on man like Digitalis in arresting the action of the heart. The Irish Yew is a variety.

Yacca (*Podocarpus Purdieana* and *P. coriacea*). Large trees natives of Jamaica. They afford excellent hard timber.

Podocarpus Totara. A large tree with tough wood, native of New Zealand; *P. spinulosa* of New South Wales; Yellow Wood (*P. elongata*) of South Africa, and *P. latifolia* of India, are large trees affording good timber. *P. cupressina* is a large tree in Penang and Java, attaining the height of 200 feet. In New Zealand *Dacrydium Cupressinum* is a beautiful and lofty tree, with slender pendulous branches, compactly covered with heath-like leaves. A beverage like spruce beer is made from its young shoots.

Huon Pine (*Dacrydium Franklinii*). A large and lofty tree, native of Tasmania. Specimens of it are found in a fossilized state, which are white, and being easily separated into pieces, show the structure of the wood very distinctly.

Celery-leaved Pine (*Phyllocladus rhomboidalis*), also a native of Tasmania, and *P. trichomanoides*, native of New Zealand, are remarkable trees, having no true leaves, their place being supplied by broad dilated branches, which are more or less notched or cut, having the appearance of leaves.

Maidenhair Tree (*Salisburia adiantifolia*). This remarkable tree is a native of Japan, and was introduced more than a hundred years ago. It is the only deciduous tree of the family, and also differs in having broad two-lobed leaves with longitudinal forked veins, and the likeness of the leaves to the Maidenhair fern has led to it being called by the above name. This, with the yew and a species from Japan, are the only ones of the family that withstand the winters of this climate.

Allied to *Pinaceæ* is a small family called *Gnetaceæ*, founded on the genus *Ephedra*, and the curious plant named by Linnæus *Gnetum Gnemon*, native of India. A small tree with

jointed branches, and opposite net veined leaves. *Ephedra* being rush-like shrubs with small scale-like leaves. The flowers are terminal and unisexual. In Europe the family is represented by the genus *Ephedra* of which there are two species, *E. distachya* and *E. monostachya* commonly to be seen in botanic gardens. About 20 species are known of this family.

They have no special qualities except in their native localities, where the seeds of some are eaten.

The rush-like stems of Ephedra present a strong contrast to a plant of recent discovery associated with them, named *Welwitschia mirabilis*. This plant consists of a hard woody obconical mass, in old plants not rising more than a foot above the ground, of nearly a circular form, and according to age, varying in diameter from a few inches to 5 or 6 feet, having a long tapering taproot, penetrating deeply into the earth. Its surface is nearly flat, rough, and cracked and depressed towards the centre, seemingly as it were divided in two by a furrow. Round the margin is yearly produced several forked flowerstalks rising about a foot in height, bearing round or four sided cones about an inch or more in diameter at the base. The above is sufficient to show this as being a remarkable plant, but it is still more so by its two seed leaves being permanent, increasing in length and breadth with the age of the plant; they are of leathery texture and in old plants attain the length of 5 or 6 feet, with the breadth of a foot or more, their apex being torn or divided, and lie nearly flat on the ground in opposite directions; their original axis or point of development being overgrown above and below by the continual enlargement of the trunk, giving the appearance of the leaves being artificially inserted in two slits which extend nearly half way round, almost meeting each other. This plant was first discovered by Dr. Welwitsch, growing in stony sandy plains on the plateau of Benguela in Africa, and in similar situations by other parties in Damara-land. It is difficult to determine the age of these plants, the largest, which

have the appearance of flat tables lying on the ground, may be presumed as not being less than five hundred years old. Several specimens are to be seen in the museum at Kew.

In connexion with *Gnetaceæ*, I place the family *Casuarineæ*, which consists of a dozen or more species of slender trees or bushy shrubs; in general character and aspect resembling Conifers; agreeing with Gnetaceæ in their branches, being jointed and leafless as in *Ephedra*, but differing in the important character of their seeds being furnished with a true skin or coat, which has hitherto separated *Casuarineæ*, artificially, from *Coniferæ;* but if the recent observations made by a French botanist are admitted to be correct, which are to the effect that the seeds of *Coniferæ* are *not* naked ovules; consequently the distinction between naked and coated seeds ceases to be valued, and *Casuarineæ* thus becomes naturally allied with *Coniferæ*.

In Lindley's "Vegetable Kingdom" *Casuarineæ* is placed in alliance with the birch, willow, plane, and oak families, with which it agrees in its male flowers being produced in aments; but its slender pointed and naked branches impart to it an aspect quite alien to these families.

The Beefwood Family.

(CASUARINACEÆ.)

Leafless trees, generally with slender cord-like, pendulous branches, which are striated, with sheathing joints, having much resemblance to the genus *Equisetum* (weedy plants called Horse-tails). Flowers inconspicuous. Male flowers in spikes or catkins. Female flowers in compact heads, becoming a woody cone with many cells, each containing a small-winged nut-fruit, which, by ordinary observers, is called the seed. On immersion in water, and viewed in the microscope, it is seen to be densely covered with beautiful spiral vessels.

About twenty species constitute this family, all belonging

to the genus *Casuarina*, chiefly natives of Australia, where they have the name of "She Oaks," and on account of the red and streaked appearance of their wood, also that of Beefwood. Their sombre and drooping habit has caused them to become favourites for ornamental trees in Australia, being like weeping willows. *C. equisetifolia* is a native of the sea-shores of the Indian Archipelago and South Sea Islands, and is used for many purposes in the different localities. Its hardness has obtained for it the name of Iron-wood. The bark furnishes a dye, and the burnt ashes is made into soap. It has a smooth bark, and even in the oldest parts of the stem shows the ringed joints, while in *C. torulosa* the stem is rough, with projecting corky bark divided by deep furrows. Plants of it are cultivated in this country as curiosities, and several old specimens at Kew have attained the height of twenty feet.

CLASS V.—RHIZOGENS.

Fleshy, fungus-like, leafless parasites, growing on roots, trailing stems, or branches of trees. Flowers incomplete (consisting of calyx only), unisexual or bisexual, solitary, conspicuous, and composing the whole plant; or inconspicuous and numerous in heads or spikes, produced from a fleshy, thallus-like rhizome. Stamens few or many. Seeds small, chiefly microscopic, some like spores of Cryptogams; their mode of germination unknown.

This singular class of plants consists of about 50 species, all widely distributed throughout the tropical and sub-tropical regions of both hemispheres, their southern limit being New Zealand, and their northern the European coasts of the Mediterranean. The general appearance and fœtid odour of many of them originally led to the supposition that they were related to fungi,

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but their flower having been found to contain stamens and pistils, ranks them with flowering plants. Dr. Lindley considered them to be sufficiently characteristic to constitute a distinct class (Rhizogens). Since then the whole has been carefully investigated, and their affinities defined by Dr. Hooker; and admitting the positions to which he assigns them to be botanically correct, it is, nevertheless, unnatural so far as regards the general character of the families with which they are associated. This being the case, and considering that little is known of the true nature of their seeds, and nothing of their germination, I therefore deem it best for the purpose of this work to retain them in Dr. Lindley's Class Rhizogens, and which I place between Gymnogens and Exogens.

The Vine Rape Family.

(RAFFLESIACEÆ.)

Plant a flower only, sessile or nearly so; consisting of a tubular, bell-shaped, or spreading monophyllous, 3—4 or 5-lobed, fleshy calyx; without, or with a central corona, which forms a cup. Stamens numerous, free or monadelphous. Ovary with many placentæ, bearing numerous ovules. Seeds microscopic.

It is now fifty years since a great sensation was caused in the botanical world, by the discovery in the Island of Sumatra, of one of the most remarkable productions of the vegetable kingdom, now known by the name of *Rafflesia Arnoldi*. It was found growing on a prostrate stem of a species of *Cissus*, and from its size, fleshy consistence, and offensive odour gave the idea of it being a fungus. It consisted of 5 fleshy lobes or petals, measuring 1 yard across, being of a spotted or mottled red colour, the centre forming a circular cup-like dish, capable of holding twelve pints of

water, the whole weighing 15 lbs. On its arrival in England it was fully described by the late celebrated botanist, Mr. Robert Brown, to be a true flower having stamens in one plant and pistils in another. When young, and before expansion, it is very similar to a firm red cabbage. One or two other species have since been discovered, but of much smaller size.

About 20 species of this family are enumerated, one of the most remarkable being *Hydnora africana*, a native of South Africa, which grows on the roots of *Euphorbia*. It consists of a tubular flower from 4 to 6 inches long, and may be compared to the socket of a candlestick, but 3-lobed. The outside is of dull brown, and inside of rosy red colour, but possessing an offensive smell like putrid meat. It is, however, said to be eaten by the natives. A plant of it flowered at Kew in 1826.

In tropical America the family is represented by the genus *Apodanthes*, the flower is urceolate or bell-shaped, in size and appearance much resembling the flower of *Asarum europœum;* they grow on the branches of trees, and have been mistaken for the flowers of the trees.

The Cistus Rape Family.

(Cytinaceæ.)

Plants consisting of a simple pale coloured, somewhat fleshy flower stem, from 6 inches to a foot in height, furnished with bractæform scales in place of leaves, the upper portion being floriferous. Flowers unisexual.

About half a dozen species constitute this family, which is represented in Europe by *Cytinus Hypocistus*, found growing on the roots of different species of *Cistus* in the countries of the Mediterranean. Their general appearance is that of broom rapes, but they are distinguished by their incomplete and unisexual flowers.

The Tree Rape Family.

(Balanophoraceæ.)*

Rhizocorms, thick and fleshy (fungus-like), producing erect stems bearing compact, round, oblong heads or spikes, with numerous inconspicuous flowers enclosed in imbricate bracts.

This family consists of about 30 known species, arranged under fourteen genera. They are widely distributed, two being found in New Zealand, and one in the south of Europe, such being their extent in latitude.

Cynomorium coccineum, better known as *Fungus Melitensis*, a native of Malta, and also found in Northern Africa, the Canary islands, and Syria. It consists of a fleshy flower-stem about a foot in height, of a red colour. It was originally much valued for its medical virtues, and at Malta, when it first became known, it was specially guarded by a military sentinel, and special persons appointed to collect it. In some parts, as the Island of Lancerrotta, it is eaten by the natives, and as it grows on the roots of *Spartium monospermum* (the juniper of Scripture), may explain the passage in Job,† "juniper roots for their meat."

Sarcophyte sanguinea. A native of South Africa; it grows on the roots of *Ekebergia Capensis*, and has an offensive smell like rotten fish.

Phyllocoryne (*Cynomorium*) *Jamaicensis.* A native of Jamaica, where it is known by the name of "John Crow's Nose." In the Himalaya the natives convert the hard knots of the species that grows on the maple into drinking-cups.

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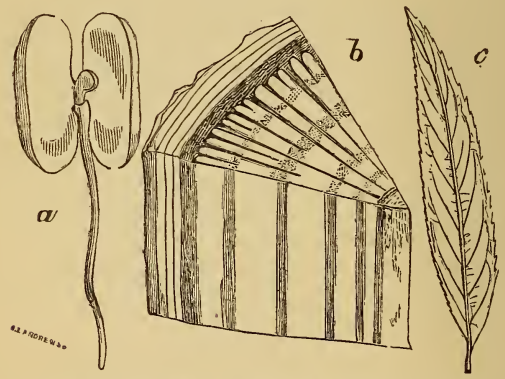
* Dr. Hooker places Rafflesiaceæ and Cytinaceæ after the ament (catkin) flowering families, and Balanophoreæ in the Evening Primrose Family Alliance.

† Chap. xxx. ver. 4.

CLASS VI.—EXOGENS.

Embryo with two cotyledons. Leaves with netted veins. Stems undefined or rudimentary only, or defined and increasing in height and girth by the annual growth of new wood to the exterior side of the preceding, enclosed in true bark (*fig.* 13, *a*, *b*, *c*).

Fig. 14.



a. Seed germinating; *b*. Vertical and transverse section of stem; *c*. leaf showing the netted veins.

This class contains the greatest portion of the Vegetable Kingdom, and is readily known by the leaves being net-veined. It comprehends all the trees and shrubs seen in the open air in this country, as well as many herbaceous plants. The principal divisional characters of this class are derived from the flowers being complete or incomplete, the corolla monopetalous or polypetalous, and ovary inferior or superior, the primary divisions being—

1. *Achlamyds.*—Flowers generally unisexual, destitute of calyx and corolla; their absence being repre-

sented by scales, bracts, or involucre, which are in some highly coloured.

2. *Monochlamyds.*—Flowers unisexual or bisexual, furnished with a calyx which is often highly coloured, like a corolla; often small or rudimentary.

3. *Dichlamyds.*—Flowers generally bisexual, with a calyx and corolla; the latter sometimes suppressed or small and rudimentary.

These characters are common to the greater number of species of each division, but there are many exceptions, especially in dichlamyds, many having unisexual flowers.

Division I.—Achlamyds (character as above).

THE WILLOW AND BIRCH ALLIANCE.

The male flowers in this and the following alliance being produced in *Aments*, are therefore generally known by the name of *Amentaceæ*. Their leaves are simple, entire or variously lobed; the Walnut family is, however, an exception, the leaves being winged, and with the branches possess a resinous fragrance, which with the special character of the fruit, serves to give this family a claim of relationship with the *Terebinth* alliance, their only connexion with the present being their incomplete flowers, and the males being in true Aments.

The Willow Family.

SALICACEÆ.

Trees or shrubs, some creeping on the ground. Leaves deciduous, alternate, simple, rarely serrated. Flowers monœcious or dicœcious, males in catkins. Stamens free or monadelphous; female (ovary) solitary, 1-celled, becoming a two valved fruit containing many feathery seeds.

This family is represented by about 170 species belonging

to the genera *Salix* and *Populus*, all being natives of the northern hemisphere, chiefly in temperate regions, and extending to the limits of vegetable life in the Polar regions; *Salix herbacea*, a small creeping plant, being found on the shores of Baffin's Bay. They contain tannin, and a principle like "Quinine" called "Salicine."

Osier (*Salix viminalis*). This plant affords the Osier Willows used for basket making, and although much cultivated in this country, the supply is not sufficient, large quantities being yearly imported from Holland.

Bitter Willow (*Salix purpurea*). An osier extensively grown in some places; it is remarkably bitter, even to that extent that it escapes the ravages of rabbits.

Sallow (*Salix caprea*). This with several other species are known by the name of sallows. Their rods are used for many purposes; for basket making they are cut at one year's growth, but for making hoops they require to be two or three years old.

White Willow (*Salix alba*), also called the Huntingdon Willow. This species and *Salix Russelliana* are large trees affording useful timber for many purposes, the wood being light and firm. Cricket bats are made of it.

Weeping Willow (*Salix babylonica*). This, as the name implies, is a native of the country about Babylon; where, as the following lines show, willow trees flourished 2500 years ago. "By the rivers of Babylon, there we sat down, yea, we wept, when we remembered Zion. We hanged our harps upon the willows in the midst thereof."*

It is not known if at that period the branches of the trees were naturally pendulous, or as some fancy, they became pendulous with the weight of the harps, from which sprung the weeping willow.

It was introduced to this country about the end of the seventeenth century, the original tree being long famed as growing in Pope's garden at Twickenham. On account of a

* Psalm cxxxvii. vers. 1 and 2.

weeping willow growing over Napoleon's grave at St. Helena, and a twig from it having been received at Kew in 1825, it was thus brought into special notice, crowds of people coming to Kew to see it, French visitors even paying reverence to it. This twig, in 1867 had attained the height of 40 feet, when it was cut down.

Willows are frequently mentioned in the Bible. They were in especial request at the Feast of Tabernacles.

S. caprea is well known as the goat willow, growing in hedges and road sides. It has large yellow catkins, and as it is generally in flower about Palm Sunday, it is by many people gathered and worn as an emblem of that day, and is known by the name of "Palm."

The species of willows are very variable, but their distinctions are not well determined; about 38 are described by some botanists as natives of Britain.

White Poplar (*Populus alba*), Grey Poplar (*P. canescens*), natives of Europe, *P. monolifera* and allied species of North America, are large and fast growing trees. Poplar timber being light and white is more or less used for many purposes; that of the grey poplar is used by millwrights, also for the handles of brooms and mops, and for making cricket bats.

Lombardy Poplar (*Populus fastigiata*). This erect pyramidal tree is well known in the neighbourhood of London. It abounds in Italy, but is believed to be a native of the mountains of Western and Northern Asia.

Aspen (*Populus tremula*). The trembling poplar is a native of Britain, and is a fast growing tree, the character of the family being remarkably shown by the continual twirling and rustling of the leaves in this species.

The Birch Family.

(Betulaceæ).

Trees or shrubs, with entire or lobed leaves having stipules. Flowers in catkins, monœcious, the females combined forming

a small cone of deciduous or permanent scales containing thin seed-like fruit.

About 40 species constitute this family, the greater number being natives of the temperate regions of the Northern Hemisphere, where, with the poplar, willow, and white spruce, they extend to the limit of tree life, and are also sparingly found in high southern latitudes.

Birch (*Betula alba*). The white birch is a well known graceful tree grown throughout the whole of Europe; in bleak rocky situations it assumes the habit of a shrub. Its wood and bark are used for many domestic purposes; in Lapland bread is made from the bark, in Russia an oil is extracted from it and used in the preparation of Russian leather, and imparts the well-known scent to it. Its sap flows freely in the spring, and as it contains a quantity of sugar it is fermented and forms a pleasant wine called birch wine.

Paper Birch (*Betula papyracea*). A native of North America. It has a very thick bark, which is taken off in large sheets, and by uniting them canoes are made of it—some large enough to carry about a dozen people. It is also made into shoe soles and domestic utensils.

Black Birch (*Betula nigra*). Also a native of North America. Its timber is tolerably hard, and is used for many purposes.

Alder (*Alnus glutinosa*). A small tree common in this country and throughout Europe. It has soft wood, which soon decays, but is of great durability when placed under ground or in water. In some places it is largely grown for making charcoal, which is used in the preparation of inferior kinds of gunpowder. Bowls and other domestic utensils are made of the wood.

The Candleberry Myrtle Family.

(Myricaceæ.)

A small family consisting of about forty species of shrubs, scarcely attaining a height sufficient to be called trees, having

simple alternate leaves, generally of a resinous nature. The flowers are small and inconspicuous, producing a berried drupe coated with a waxy secretion affording an excellent wax, which is extensively collected from the different species in the countries where they grow, and used for making candles. They are natives of North and South America, the Cape of Good Hope, and India. The Sweet Gale Bog Myrtle or Candleberry Myrtle (*Myrica Gale*) is a well known fragrant shrub, growing in boggy places in this country. *Myrica Nagi*, a native of Japan, bears a fruit similar to that of the strawberry tree, known by the name of *Yangmæ*. The plant has lately been introduced to this country.

The Liquidambar Family.

(ALTINGIACEÆ.)

Deciduous trees with lobed glandular toothed leaves furnished with stipules. Flowers in catkins. Fruits united, forming a cone of hard scales, containing 2-celled, 2-lobed capsules, with winged seeds.

This small family is represented by not more than three known species. *Liquidambar Styraciflua*, a moderate-sized tree, native of North America, and *L. orientale*, often called *L. imberbe*, a native of Syria and southern parts of Eastern Europe. Both yield the gum storax of commerce, the chief supply coming from ports in the Mediterranean. *L. Altingia*, native of the Malayan Archipelago, also yields liquid storax.

The Plane Tree Family.

(PLATANACEÆ.)

Large trees with lobed palmate deciduous leaves, furnished with sheathing stipules. Flowers in bisexual catkins. Fruits united in globose, pendulous heads, consisting of a mass of woolly scales, in which the small one-seeded nut fruits are imbedded.

A small family consisting of about 5 species, natives of Syria, Himalaya, and North America.

Eastern Plane (*Platanus orientalis*). A noble tree attaining the height of from 60 to 80 feet, and when standing singly has wide-spreading branches, being well known in parks and gardens in this country as a highly ornamental tree.

P. acerifolia, believed to be a distinct species, is much grown about London as the Oriental Plane; it differs in its leaves, not being so deeply cut, and it is less disposed (as in the true plane) to branch horizontally.

It is conspicuous in the vicinity of Mount Lebanon, one near Damascus measuring 40 feet in circumference.

Western Plane (*Platanus occidentalis*). A tree attaining a large size, native of North America. In this country it is often injured by the spring frosts, and about the year 1811 many trees of it were killed in Scotland and in England.

P. racemosa, a native of California, *P. Lindeniana* and *P. Mexicana*, of Mexico, are said to be distinct species.

Plane tree wood is much prized by cabinet-makers, as it takes a fine polish.

THE HAZEL NUT AND OAK ALLIANCE.

The Oak Family.

(CUPULIFERÆ.)

Large trees or shrubs, with alternate simple or lobed leaves, furnished with stipules. Flowers generally in catkins, monœcious, or diœcious. Fruit a 1-celled hard-shelled nut, single in a cup, or several together in a valved involucre, which is sometimes winged.

This family consists of about 330 species, of which about 280 belong to the genus *Quercus*, the greater portion of that number forming extensive forests throughout the Northern, but less abundant in the Southern hemisphere.

Evergreen Beech—*Fagus betuloides* and *F. Forsteri*—are

natives of Terra del Fuego, forming large trees. *Fagus fusca* of New Zealand, and *F. Cunninghamii* of Tasmania, are also large trees.

Plants of these are grown at Kew, but, with the exception of *F. betuloides*, are not hardy, and even it, after standing the winters of twenty years, and attaining the height of 8 feet, was destroyed by frost in January, 1867.

British Oak (*Quercus sessiliflora* and *Q. pedunculata*). Botanists do not agree as to whether the trees bearing these names are distinct species or varieties only. They are, however, found to differ in the quality of the timber, and in the acorns of the first being without a footstalk, while in the second they hang loose. Both are natives of this country, and throughout middle and northern Europe. The oak was venerated by the Druids, and in ancient parks some trees have attained a great size and age. The principal use of oak timber is for ship-building. The wood of *Q. sessiliflora* is the heaviest and toughest; that of *Q. pedunculata* being like chestnut, is much used by cabinetmakers for ornamental work. Oak bark is used for tanning leather, and of all the substances known for that purpose that can be had in quantity, British oak bark is found to be the best; but the home supply falls far short of the demand, large quantities being imported from the Continent. It is also of great value in the preparation of dyes. The spent bark of tan-works is of little value as manure; it ferments and maintains heat a long time, and on that account is used in hot-houses, chiefly for the cultivation of pine-apples.

Turkey Oak (*Quercus cerris*). A large and handsome tree, generally with spreading branches, native of the South of Europe, and was introduced to this country about one hundred and twenty years ago. Its wood is much used in turning and cabinet work.

Cork Tree (*Quercus Suber*). A common tree throughout all the southern parts of Europe. It has a thick bark, from which corks and bungs are made, large quantities of it being imported from Spain.

Kermes or Holm Oak (*Quercus coccifera*). A small evergreen tree, native of the countries bordering on the Mediterranean, also of Palestine. A bug-like insect (*Coccus Ilicis*), infests the trees, covering them with a flocky matter similar to the apple-tree blight. The insect is extensively collected, and yields a scarlet dye nearly equal to cochineal, and is the "scarlet"* mentioned in Scripture.

Oak Galls (*Quercus infectoria*). A tree, native of the Levant. It produces the best galls of commerce, which are used in the manufacture of ink, and for dyeing purposes. They are an extraneous production caused by the puncture of an insect, a species of *Cynips*, laying its eggs on the leaves and twiggy branches of the tree, causing an unnatural growth that becomes a gall and contains the pupa of the future insect. They are found abundant on oak trees in this country, well known as oak apples, but not of the quality to be useful; they are injurious to the trees.

Valonia (*Quercus Ægilops*). Also a native of the shores of the Mediterranean and Levant, from whence large quantities of acorn cups are imported for tanning and dyeing.

Belotes (*Quercus Ballota*). Native of the South of Europe. In Spain and opposite parts of the African coast it grows abundantly, and the acorns are used for food.

It is abundant in Palestine, forming a tree from 20 to 30 feet high, and 3 to 7 feet in girth, having stout limbs, and is supposed to be the Oak of Bashan. The acorns are large, of a green colour, and remain soft when ripe; they are sold in all the bazars, and are eaten either raw or boiled. Ornaments are made of the cups.

Evergreen Oak (*Quercus Ilex*). Also a native of the South of Europe, and long grown in this country, being the largest and handsomest of our evergreen trees; it occasionally suffers in severe winters.

Abram's Oak. Oak of Mamre (*Quercus pseudo-coccifera*). A fine specimen of this grows on the spot where it is sup-

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* Exodus, chap. xxv. ver. 4.

posed the tree stood under which Abraham entertained the three angels,* but what that tree was cannot be ascertained. It is believed that if any person cuts or maims it, he would lose his first-born son. This oak is of moderate height, having a trunk 23 feet in girth, and 90 feet spread of branches, and although it has the appearance of being a very old tree, yet it could scarcely have been in existence in the time of Abraham. In the winter of 1856–7, it suffered the loss of a large limb, which was broken off by a heavy fall of snow.

Oaks abound from the equator, north, through Central America, Mexico, and northward into Canada. Several Mexican and other southern species have been introduced, but do not prove hardy. The North American species are large handsome trees, some being more than 100 feet in height. Most of them are hardy, and have been well known in this country for more than one hundred years, many being very ornamental.

About a dozen species have been introduced from Northern India, but they are not sufficiently hardy to live in the open air in this country. Several species have also lately been introduced from Japan and China, but their qualities have not yet been ascertained.

A kind of silkworm feeds upon the leaves of *Quercus mongolica* and *Q. dentata*, natives of Northern China, where extensive tracts of hill country are covered with them, and which are species scarcely differing from the common oak.

Beech (*Fagus sylvatica*). A well known European tree, also found in Western Asia. Its hard wood is used for chair making, and for many other domestic purposes, and an oil is expressed from the nuts. Purple beech is only a variety.

Chestnut (*Castanea vesca*). The Sweet or Spanish Chestnut is a native of temperate Western Asia, and the east throughout the range of the Himalayas. It has been known from the

* Genesis, chap. xviii. vers. 4 and 5.

earliest period of history, and the name occurs in two places in the Bible.* Doubts are however entertained by commentators as to whether the tree there spoken of is the same as the one now known as Chestnut, some supposing the Plane tree (*Platanus orientalis*) is meant. It is said to have been first brought to Europe by the Greeks, from Sardis in Asia Minor, at least five hundred years before the Christian Era, and Theophrastus writing two hundred years after, speaks of Mount Olympus being covered with Chestnut trees. From thence it was introduced to Italy, and afterwards gradually spread throughout Southern and Middle Europe, and is believed to have been introduced to this country by the Romans, and was long thought to be a native, on account of the roof of Westminster Hall and other ancient buildings being supposed to be chestnut wood. But it has been proved that the timber used is not chestnut, but an inferior sort of oak, called Denmark Oak (*Quercus sessiliflora* of botanists).

The nut of the Sweet Chestnut is too well known to need description. It Italy and Spain it forms the principal food of the poorer classes, who grind it into meal.

In this country the nuts ripen tolerably well in fine seasons, yet the quality and quantity is small compared to the importations which come chiefly from Holland and Belgium.

Hazel and Filbert Nuts (*Corylus avellana*). A small bush, throwing up straight rod-like stems, growing wild in woods throughout this country, as also in the temperate parts of Europe, as well as in Western and Northern Asia. The specific name *avellana* is derived from the name of a place in Italy, where large quantities are grown for exportation. The great supply of the finest nuts comes from Spain, and are called Barcelona nuts.

In this country nuts are extensively cultivated, especially about Maidstone, in Kent.

Cob and filbert nuts are only varieties, the latter having a

* Genesis, chap. xxx. ver. 37; Ezekiel, chap. xxxi. ver. 8.

longer cup covering than the hazel. Hazel rods are largely used in making hoops and crates for packing merchandize in. In the book of Genesis, hazel, chestnut, and poplar are mentioned as being the rods which Jacob peeled and placed before the cattle.* It is, however, a matter of doubt whether these were the trees known by the same names in the present day.

Hornbeam (*Carpinus betulus*). A well known tree in this country, and throughout Europe. Its hard timber is used for many domestic purposes.

Hop Hornbeam (*Ostrya vulgaris*). A handsome tree with a bushy head, attaining the height of about 40 or more feet. It is a native of the South of Europe, and is distinguished from the common hornbeam by the fruit catkin being similar to that of the hop, but it is of no use.

A very old and handsome tree is to be seen in the grounds of the original Botanic Gardens at Kew.

The Walnut Family.

(JUGLANDACEÆ.)

Large trees with alternate winged leaves of a resinous, aromatic odour. Male flowers in catkins; female (ovary) solitary. Fruit, drupe-like, formed of a thick rind containing a hard furrowed shelled nut-seed, or cone-like, with numerous small bracts as in *Fortunea*.

This family is represented by about 30 species, the greater number being natives of North America, where they form large forests; also throughout northern temperate Asia from the Caucasus eastward.

Walnut (*Juglans regia*). The walnut has long been known in this country. It is a native of western Asia throughout the range of the Himalaya eastward to China, and is greatly cultivated in Cashmere.

It is supposed not to have been a native of Europe, but

* Genesis, chap. xxx. ver. 37.

was introduced from the east in very early times, and is now abundant throughout middle and southern Europe. The wood is valued by cabinet-makers for its beautiful veining and dark colour. An oil is extracted from the nuts equal to olive oil, which is greatly used by painters, and forms a considerable article of trade.

The nutty part of the walnut eaten is the two seed-lobes or cotyledons, which are crumpled up in the shell. Although a considerable quantity of walnuts are produced in this country, they nevertheless fall far short of the demand, large quantities being imported from France, Belgium, Holland, the Two Sicilies, and other places.

Black Walnut (*Juglans nigra*). A large tree, native of North America. It is much valued on account of its wood, which is prized for making gun-stocks.

Hickory nut (*Carya alba*). A large tree of North America, yielding the white hickory nut, which is greatly eaten in the United States, and occasionally imported into this country.

Picary nut (*Carya olivæformis*). A tree, native of the south and western States of North America, the nut of which is considered a great delicacy. A small quantity has occasionally been imported from New Orleans.

Pterocarya caucasica. Is a large tree, native of the Caucasus. A plant was received at Kew about forty years ago, which is now a handsome spreading branched tree, 12 feet high, with a girth of stem of $2\frac{1}{2}$ feet. It differs from the walnut in having a winged fruit.

Fortunea Chinensis. Is a curious plant of the family, native of China, introduced by Mr. Fortune about twenty years ago. A plant at Kew, 3 to 4 feet high, had the habit of a small tree with winged leaves, like a small-leaved ash; it produced female flowers, which consist of imbricated scales, forming a firm cone-like catkin, each scale bearing in its axis a small 1-seeded 2-winged nut.

Division 2.—Dichlamyds (page 211).

THE BREAD FRUIT, MULBERRY, AND NETTLE ALLIANCE.

The Bread Fruit Family.

(ARTOCARPACEÆ.)

Trees or shrubs with alternate, entire or lobed leaves, and deciduous stipules. Flowers inconspicuous, monœcious or diœcious; males in compact catkins, females closely seated on a globose or oblong receptacle (clinanthium), which becomes a fleshy mass, when perfect containing numerous 1-seeded nut-like fruits; often abortive.

This family consists entirely of tropical trees, of which above 50 species are enumerated. They abound in a thin milky juice, and possess tough fibrous bark.

Bread Fruit (*Artocarpus incisa*). A tree, native of Otaheite, and other islands of the Pacific Ocean, attaining the height of 20 to 30 feet, having spreading branches and rough, lobed leaves. Its fruit (so called) consists of a spongy receptacle of a globose or oblong form, like a large melon, about a foot in length; it is marked on the exterior in a diamonded manner, each mark indicating the place of a female flower. The true fruits consist of nuts imbedded in the mass, but are seldom produced in trees under cultivation. Bread fruit, with the cocoa nut and banana, composes the principal part of the food of the natives of the Pacific Islands. It is of a white and firm texture, something like wheaten bread, and not unpleasant to eat. The bark is very tough, and when beaten out forms the whitest and finest native cloth.

The Bread Fruit tree was first brought specially into notice by the voyages of Captain Cook, and its fame as a food plant led the British Government to deem it worthy of being naturalized in the West Indies. Accordingly, in 1787, the ship *Bounty*, commanded by Captain Bligh, accompanied by

David Nelson, a gardener (who had accompanied Captain Cook in his third voyage), was despatched to Otaheite to obtain a cargo of young trees. This being accomplished, the ship sailed from Otaheite with every prospect of the undertaking terminating successfully; but they had not long left Otaheite when a mutiny broke out on board, and the Captain, Nelson, and other officers, and others of the crew who would not join the mutineers, were put in an open boat and set adrift in mid-ocean, the nearest place where European aid could be obtained being the Island of Timor, 3618 miles distant, which place they reached after enduring great fatigue and hardship, from the effects of which Nelson did not recover, having died there in July, 1789. On Captain Bligh reaching England, he was again despatched on the same mission in the ship *Providence*, having with him Christopher Smith, a gardener from Kew, this time proving successful; and in 1793 Bread Fruit trees were flourishing in Jamaica, and other West Indian Islands, and soon became common in all tropical countries favourable to their growth.*

Jack Fruit (*Artocarpus integrifolius*). A native of the Indian and Malayan Archipelagos, where it is extensively grown for the sake of the fleshy envelope of the fruit. It is not so palatable to Europeans as the bread fruit; it is about the size of a large vegetable marrow, often from 12 to 18 inches in length and 6 to 8 inches in diameter; its nuts, which are the true fruits, are roasted and eaten. The whole of the family contains a large quantity of watery or milky juice, the latter being abundant in *Castilloa elastica*, a tree of considerable size, native of Cuba, Mexico, and other parts of Tropical America; the juice contains a considerable quantity of Caoutchouc, which is generally known in commerce by the name of Mexican and West Indian Caoutchouc, which will be specially noticed under the Euphorbia family.

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* Full particulars of these voyages are recorded in the "Mutiny of the Bounty."

Bread-nut Tree (*Brosimum Alicastrum*). A large tree, native of the West Indies. It has lance-shaped leaves, and fruit about the size of a plum, containing one nut-seed, which, when roasted, is eatable. The wood has a fine grain like mahogany.

Letter-wood, Snake-wood, or Leopard-wood (*Brosimum Aubletii*). Also a large tree, native of Tropical America, and has been found in Trinidad. Its beautiful mottled and streaked wood is much valued by cabinet-makers, and is used for inlaying.

Cow Tree (*Galactodendron utile*). This is the Palo de Vaca or Cow-tree, first described by Humboldt. It is a native of Venezuela, where it attains the height of from 80 to 100 feet and forms large forests; it has oblong pointed leaves, of a rusty colour on the under side, and is strongly veined and firm. On incisions being made in the trunk, a copious flow of milky sap is obtained of a balmy flavour, which is extensively used by the natives as a substitute for milk, and has been daily used by Europeans without producing any ill effects. With this knowledge, and impressed with Humboldt's comparing the trees to cows, an Englishman was led to entertain the project of introducing and naturalizing them in this country, thus conferring a great boon on the people; accordingly in 1830 he arrived in England with a great number of trees, it was said 1000. To his philanthropic views he added that of profit, and expected that his trees would be eagerly purchased for a guinea each, but in this he was disappointed, for few were bought, tree-cultivators being aware that a forest-tree from Venezuela could only be grown as a curiosity in a hothouse, which circumstance had not been thought of by the speculator; and further, it was afterwards found that his trees were not "cow-trees," but a species of *Achras*, as proved by one of the trees grown at Kew.

Upas Tree (*Antiaris toxicaria*). A tree, native of Java, growing in low valleys that become filled to a certain depth with carbonic acid gas, which, on any person entering proves

fatal to life. The Upas tree was blamed as being the cause of this. The tree is, however, not harmless, as evil effects have been experienced after handling the leaves and branches.

Sack Tree (*Antiaris saccidora*). A large tree, native of Western India, having a very tough, close, fibrous bark, the inner portion of which is converted into sacks; this is accomplished by cutting trees in lengths the size wanted, and pulling the bark over the wood; thus a complete sack is at once obtained.

Antiaris Bennettii. A native of Tropical New Holland, also the Fiji Islands. A medium sized tree with long glossy leaves. Fruit the size of an apricot, covered with velvety down. In Fiji it is planted near temples. The gum is used for poisoning arrows.

The Mulberry Family.

(Moraceæ.)

Trees or shrubs, sometimes rooting and climbing like ivy, often with thorns. Leaves alternate, rarely opposite, entire or lobed, generally rough and furnished with deciduous stipules. Flowers inconspicuous, monœcious or diœcious; males in spikes; females seated on or within a globose or oblong fleshy receptacle, which becomes the fruit so called.

Nearly 200 species are enumerated in this family, the greatest number belonging to the genus *Ficus*, natives of the tropics; they are also represented in North America and Australia, in some countries forming large trees. The following account of one growing on a mountain in the centre of Trinidad has lately been received. "We carved our names on a gigantic ficus near the summit, with the date of our visit. This tree is a noble specimen; four of us standing on its spurs 6 feet above the ground, could only just span it." In general they abound in a milky juice which in many species afford Caoutchouc.

Fig (*Ficus Carica*). It is generally understood that the

fig is a native of Western Asia, and was in early times introduced to the islands of the Mediterranean and Southern Europe, where it has become indigenous and occasionally attains the height of a tree. The fig is not a true fruit, but a fleshy receptacle of a conical form, attached by the narrow end, the broad end or apex having a small opening like a pore, the true flower and seed lining the interior, which may be seen on opening a fig. The fertilization of the fig being considered peculiar, is termed caprification; it is believed to be promoted by a small winged insect, called *Cynips*, entering the young fruit by the pore at its apex, and by the movements of the insect the pollen is loosened from the anthers, and thus comes in contact with the stigmas, as effected by insects in the flowers of other plants. There are many fine varieties cultivated. The dried figs that come to this country form a large article of trade with Turkey, the islands of the Mediterranean, and part of the African coast. The first notice of fig trees appears in Deuteronomy, chap. viii. ver. 8.

Sycamore Fig Tree (*Ficus sycamorus*). A bushy tree from 30 to 40 feet high, forming considerable shade, having lobed heart-shaped leaves something like the common fig, but smaller. It is a native of Syria and Egypt, and has been called Pharaoh's fig. The fruit is small, but produced in great abundance, and is extensively used in Egypt for food. Although its wood is light and soft, it is nevertheless very durable, mummy coffins of ancient date having been found made of it.

That the sycamore tree was common in Palestine appears evident from the circumstance that King Solomon made cedars "to be as the sycamore trees that are in the vale, for abundance;"* also that it grew in the neighbourhood of Jerusalem in the time of Christ, as we read that Zacchæus "climed up into a sycamore tree."†

India-rubber Tree (*Ficus elastica*). A well-known tree in this country, its large shining leaves causing it to be a

* 1 Kings, chap. x. ver. 27. † St. Luke, chap. xix. ver. 4.

great favourite. It is a native of the East Indies. India-rubber (see *Caoutchouc*) is obtained from it, and its leaves are greatly valued for skeletonising.

Banyan tree (*Ficus indica*). In India this is an immense spreading tree, with broad, oval, firm leaves; it emits aërial roots from the branches which descend like ropes, entering firmly into the ground, according to age thickening and becoming like pillars, the branches continuing to extend and cover a vast extent of ground.

Pipel Tree (*Ficus religiosa*). Also a large aërial rooted tree which is held sacred by the Hindoos. The leaves are heart-shaped, terminating in a long point.

Mulberry Tree (*Morus nigra*). The common black mulberry is believed to be a native of Western Asia; it was early introduced to Europe, its leaves being used for feeding silk-worms. It appears to have been introduced to this country more than three hundred years ago, but the climate not being favourable for the production of silk, it is chiefly valued for its fruit, which consists of a number of one-seeded ovaries connected together by their enlarged pulpy calyxes.

White Mulberry (*Morus alba*), said to be a native of China, was early introduced to Europe, and has now almost superseded *M. nigra* for the feeding of silk-worms.

The first notice of mulberry trees in Scripture is in 2nd Samuel, chap. v. ver. 23–24, and the first recorded use of silk is in Ezekiel, chap. xvi. ver. 13, but it is probable that the latter article was known in the time of Solomon. Silk now forms one of the most valuable articles of commerce throughout the world, the principal imports to this country coming from China and India. It is also largely produced in Western Asia and the South of Europe, especially in Italy and the South of France. The mulberry tree is considered by some to be the sycamore tree* of Scripture.

Osage Orange (*Maclura aurantiaca*). A native of North America. It forms a straggling tree which, on account of

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* St. Luke, chap. xvii. ver. 6.

its strong spines, is often used as a hedge plant ; it is hardy in this country and forms a low shrub. The fruit (so-called) consists of a firm fleshy globose receptacle the size and colour of an orange, but is not eatable.

Fustic (*Maclura tinctoria*). A native of the West Indies and Tropical America, often forming a large tree, with small, entire roughish leaves. Its wood is yellow and is the Fustic wood extensively imported to this country for the use of dyers.

Paper Mulberry (*Broussonetia papyrifera*). A small tree from 20 to 30 feet high, with rough, entire, or variously lobed leaves. It is supposed to be a native of China and Japan, where it is extensively cultivated for its bark, which is made into paper. It is also widely spread throughout the islands of the Pacific Ocean, where the bark is beaten out by the natives and made into Tapa cloth, which forms their chief article of dress.

The Nettle Family.

(URTICACEÆ).

Trees, shrubs, frutlets, perennial or annual herbs, often weedy, leaves alternate, entire or lobed, generally furnished with stinging hairs. Flowers inconspicuous, in heads, spikes, or panicle-like catkins, sometimes very long ; generally unisexual. Fruit small, generally imbedded in a fleshy calyx, in *Boehmeria* berry-like, or dry as in nettle.

Upwards of 300 species are enumerated of this family, being represented throughout the temperate and warm regions of the earth. By many botanists the bread fruit and mulberry families were associated with the present one, and though their mode of flowering and fruiting is very different, yet botanically it is not so, and it is more their habit that favours their separation ; and being devoid of milky juice. The habit of the genus *Dorstenia* appears to agree best with the nettle, its receptacle possessing the character of the nettle, fig, and bread fruit, and seems to unite these families.

Nettle (*Urtica dioica*). The common nettle, with many

other species, are well known for their stinging qualities. *Urtica urens*, an Indian plant being of dreadful renown; it, however, has its equal in two species natives of Australia. *U. morioides*, a small tree or bush with mulberry-like leaves, and *U. gigas* a tree of New South Wales, which attains the height of from 70 to 80 feet, often being swollen at the base forming buttresses many feet in diameter. It has large heart-shaped leaves, the effects of which (when touched) are not easily forgotten, cattle coming in contact with them becoming furious. The wood of the latter is porous and even lighter than cork. *U. photinifolia* is a large much-branched tree, native of Moreton Bay, having elliptical shining leaves, with scattered irritant prickles. The three species were introduced to Kew about forty years ago.

Grass Cloth (*Boehmeria nivea*). A perennial plant, native of China. It sends up numerous rod-like stems, 4 to 6 feet high, having heart-shaped leaves, silvery white on the under surface. It has fine fibre, which is now imported in considerable quantity from China and India, and woven into the fine linen-like cloth known as "China Grass Cloth." It is now extensively cultivated in the Southern United States, and the British Government have lately become interested in its cultivation in the colonies favourable to its growth. There is, however, some difficulty in separating the fibre from the bark and wood, which has led the Government of India to offer a reward of 5000*l.* for the best mode of overcoming the above difficulty.

It grows freely in this country, but in severe winters is liable to be injured; but it might be profitably cultivated in Cornwall and the western counties. The fibre called Rhea is supposed to be the produce of this or a closely allied species.

Puya Fibre (*Boehmeria Puya*), is a plant similar to the preceding in habit of growth, but has longer leaves. It is extensively cultivated in Upper India; the fibre is used for making ropes and sailcloths.

Contrayerva Root (*Dorstenia Contrayerva*). A frutlet

plant, native of tropical America, with rough heart-shaped leaves. The roots are imported to this country for medical purposes.

The Hemp Family.

(CANNABINACEÆ.)

Erect or twining herbs, with angular rough stems and alternate-lobed leaves. Flowers in catkin-panicles, inconspicuous, unisexual or bisexual.

This family is represented by only two species, the Hemp and Hop.

Hemp (*Cannabis sativa*). An annual plant found wild in northern India and the western parts of Asia, but now generally cultivated in temperate and warm regions. It attains an average height of from 8 to 10 feet, but sometimes exceeds the latter. Its fibre is the hemp of commerce, imported to this country from many parts, the greatest supply being from Russia, and the finest from Italy.

In India the dried plant is known by the names of *Gunjah* and *Bhang*. *Gunjah* is smoked like tobacco, *Bhang* is macerated in water and made into a drink; both are stimulating and intoxicating.

A resin is collected from the plant, called *Churras*, in which the properties of *Gunjah* and *Bhang* are concentrated. It is collected by coolies, who run violently amongst the plants, the resin sticking to their bodies, or to skins with which they are purposely clothed. This resin when used in small quantities produces pleasant sensations, but if taken in excess leads to insanity. The seeds are used for feeding caged birds.

Hop (*Humulus Lupulus*). A well known perennial plant, found wild in the eastern parts of Europe, and was known to the ancients. It is now generally cultivated throughout Europe, and was introduced to England about three hundred years ago. The female flowers consist of leafy cone-like catkins (strobili), of a light colour, which are called Hops, and are well known as giving the best bitter to beer. It is

extensively cultivated, more especially in Kent, where the finest hops are produced.

The Bunius Family.

(Stilaginaceæ.)

Trees or shrubs, with alternate entire leathery leaves and deciduous stipules. Flowers inconspicuous, unisexual. Fruit small, drupaceous.

A small family, consisting of 20 or more species, natives chiefly of the East Indies and Madagascar, the principal being *Antidesma alexiteria*, *A. paniculata*, and *Stilago Bunius*. They are trees with laurel-like leaves which are subacid, and when boiled are used in India in cases of syphilis. The succulent fruits are eaten, and are sometimes preserved. The bark of *Stilago Bunius* is fibrous, and is used for rope-making.

The Elm Family.

(Ulmaceæ.)

Trees or shrubs with alternate simple entire or serrated, generally rough leaves, furnished with stipules. Flowers small, unisexual (*Celtis*) or bisexual (*Ulmus*). Stamens generally 4—5; Pistils 2. Fruit a thin membranous 1 or 2 seeded samara—*Ulmus*—or a berry-like drupe—*Celtis*.

Above 60 species are recorded of this family, natives of the temperate countries of the Northern Hemisphere; they are chiefly valued for their timber.

Elm (*Ulmus campestris*). The common elm is a well known tree, valued for its timber, which is used for many purposes, particularly for works under ground or in water. The Wych elm (*Ulmus montana*) also affords good timber, but does not grow to so large a size. The elm is extensively grown in this country, lives to a great age, and is sometimes of large dimensions.

In consequence of *U. campestris* not producing perfect

seeds in this country, and there being no evidence of it being found in a wild state, it is therefore supposed that it is not a native; while *U. montana* seeds freely, and is abundantly wild in Scotland.

American Elm (*Ulmus Americana*). A native of North America, abundant in Nova Scotia and Canada, extending to the Southern United States. It is a tree resembling the English elm, but has larger leaves; the wood is used for the same purposes as the preceding, but is not so hard and is less durable. Its inner bark is very tough, and is used for weaving into seats for common chairs and the like.

Zelkona tree (*Planera Richardi*). A native of North America, becoming a large tree, attaining the height of 70 or 80 feet, having much the appearance of the elm, and in the countries where it is abundant is used for the same purposes as the oak, especially for making furniture.

Nettle Tree (*Celtis australis*). A tree 30 to 40 feet or more high, native of the South of Europe, and coast of North Africa. In some parts of France and Germany it is planted as an ornamental tree; its wood is hard and is used for furniture making. As a genus it differs from Ulmus by having a small black drupe, which is delicious and wholesome, and is eaten in some parts. It is believed by some to be the Lotos of the ancients, the food of the Lotophagi. In Greece it is called honey-berry. There are several other species natives of North America, such as the huckberry (*Celtis crassifolia*), a fine species forming large forests in some parts of the United States, having fruit about the size of a pea, which is eatable.

THE AMARANTH, DOCK, AND MARVEL OF PERU ALLIANCE.

The Cock's comb Family.

(AMARANTHACEÆ.)

Soft stemmed fruticuls, or perennial or annual herbs, rarely woody. Leaves simple, alternate, or opposite and

embracing the stem, of a soft flaccid texture. Flowers unisexual or bisexual in compact heads, spikes, or racemes; calyx coloured and scariose, often with one or more coloured bracts, which are sometimes spiny. Fruit bladder like, or a berry.

This family consists of about 500 species, all widely distributed throughout warm and temperate climates; they are of a weedy nature, their seeds vegetating freely, and readily become naturalized in new localities. In India one or more species are cultivated for their seeds, which are used as food; many are considered by the natives of the different countries to have medical qualities.

Cock's Comb (*Celosia cristata*). An annual, native of India, introduced to this country three hundred years ago; the typical form is a branching plant, bearing loose spikes of flowers. The crested head of the garden cock's comb is a monstrosity brought about by cultivation.

Prince's Feather (*Amaranthus hypochondriacus*), Love-lies-bleeding (*A. caudatus*), well known garden annuals, natives of India. *A. tricolor*, a native of China, valued for its variously coloured leaves.

Globe Amaranth (*Gomphrena globosa*). A well known tender annual, with purple and white flowers, native of India.

Iresine Herbsti, a native of Brazil, has on account of its dark sombre foliage, come into repute as a contrast of colour in flower beds.

Trichinium, a genus of Australia, has pretty plumose spikes of flowers.

The Spinach Family.

(Chenopodiaceæ.)

Herbs, perennial or annual, fruticuls or shrubs. Stems generally soft (some jointed) with alternate, fleshy, entire or lobed leaves. Flowers in spikes, compact racemes, or panicles, inconspicuous, unisexual or bisexual. Fruit membranous, dry and rough, or a fleshy berry, one seeded.

Above 500 species are recorded as belonging to this widespread weedy family, chiefly found throughout the temperate regions of the Northern Hemisphere, some growing in salt marshes and on sandy shores. The whole are wholesome.

Spinach (*Spinacia oleracea*). The native country of the garden spinach is not well ascertained, but is supposed to be Western Asia; it has been known in this country for at least three hundred years. There are two kinds, one with smooth and the other with prickly seeds. Both are cultivated and used as a vegetable.

English Mercury (*Chenopodium Bonus Henricus*), and other species of the genus, are sometimes used in this country as spinach.

Australian Spinach (*Chenopodium auricomum*). A native of the interior of Australia. It is allied to *C. hybridum*, a weedy plant of this country. It has lately come into use as a substitute for spinach.

Quinoa (*Chenopodium Quinoa*). An annual plant growing to the height of from 4 to 6 feet, producing dense erect compound panicles of flowers. It is a native of Peru, and is much cultivated in Chili and other parts of Western America for its seeds, which form a great article of food, and are considered by the miners and others employed in laborious work as very strengthening. Before the conquest of Peru by the Spaniards, it was the principal meal food of the Peruvians. In this country it is cultivated for feeding fowls, and its leaves are used as a vegetable. In the United States an oil is obtained from the seeds of *C. anthelminticum*.

Mountain Spinach, or Garden Orache (*Atriplex hortensis*) A native of Eastern Europe. It is a hardy annual plant, growing 2 to 3 feet high, having large hastate leaves, varying from light green to dark red, which are sometimes used as spinach. They seed freely, the red leaved kind becoming a weed in some gardens.

Orache or Sea Purslane (*Atriplex Halimus*). A low shrub with succulent leaves, native of the South of Europe and Western Asia, growing in desert places. It is supposed to

be the plant spoken of in the book of Job* as "Mallows." *A. portulacoides* is a shrubby species similar to the last, and abundant on the southern coasts of this country.

Strawberry Blite (*Blitum capitatum* and *B. virgatum*). Prostrate annual plants, natives of the South of Europe. They are cultivated for their leaves, which are sometimes used as spinach, and like the former, become weeds in gardens, but are interesting on account of their strawberry-like fruit, which is composed of a union of fleshy calyxes.

Beet (*Beta vulgaris*). The red beet is said to be a native of France; it was introduced to this country about two hundred years ago. Its large succulent roots are a well known culinary vegetable, either cooked or as a pickle.

Mangel Wurzel. This is understood to be the cultivated state of *Beta maritima*, a wild plant growing on the seashores of this country, and now extensively cultivated for feeding cattle. During the war between Great Britain and France, sugar became scarce in the latter country, and it being found that beet contained a quantity of saccharine matter, the Emperor Napoleon encouraged its cultivation in order to obtain sugar from it, and which has been carried on more or less in France, as well as in Germany, ever since that period. It has also become an article of manufacture in this country, where it is largely grown for that purpose.

When refined, it has the appearance of cane sugar, but is distinguished by the fracture not being so bright and the crystals less sparkling than in cane sugar. By fermentation and distillation of the juice, a large quantity of proof spirit is obtained, which is said to be used in the manufacture of a sherry wine, the refuse yielding potash. In Italy, both the red and white beet are sold in the street hot from the oven, and are eaten with bread, butter, and salt, affording a satisfactory meal to many people.

Glasswort (*Salicornia herbacea*). A succulent jointed-

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* Chap. xxx. ver. 4.

stemmed plant, native of the muddy sea-shores of this country. It grows to the height of six or more inches; the stems make a very good pickle.

Salsola Kali and *S. Soda*, are branching annual plants, having succulent almost leafless stems, growing to the height of 1 or 2 feet, and found abundantly on the sandy sea-shores of the temperate and warm countries of the Northern Hemisphere, abounding on the shores of the Mediterranean, Canary Islands, &c. By burning, a soda is obtained, which at one time was largely imported under the name of Barilla, and used for making soap and glass, but since the production of soda from common salt the imports have not been so large.

Shrubby Saltwort (*Salsola fruticosa*). An erect branching plant, 2 to 3 feet high, having small semicylindrical leaves not more than half an inch in length. It is common on the shores in warm parts of Europe, Northern Africa, and Western Asia; it is found in this country but rarely, in some parts of the eastern and southern shores only. In the South of Europe it is burned for Barilla.

Batis maritima. A low erect succulent frutlet, with small opposite leaves, and inconspicuous unisexual flowers, produced in cone-like spikes. In general habit it is similar to glasswort, with which some botanists consider it to be allied, others viewing it as the type of a special family (*Batideæ*) belonging to the Spurgewort alliance. It is a native of salt marshes in the West India islands and coasts of tropical America. In some countries it is burnt for the carbonate of soda which it contains. In Jamaica it is used as a pickle.

The genus *Basella* has been separated from Chenopodiaceæ and formed into the type of a distinct family (Basellaceæ), which some botanists place in alliance with fig marigolds. It consists of about twelve species of climbing succulent fruticuls, with alternate simple leaves, and succulent berried fruit. They are widely spread throughout the tropics, *Basella rubra* and *B. alba* having leaves like, and are used as

spinach. *B. rubra* yields a rich purple dye, but it is not permanent.

Boussingaltia baselloides, a native of the Andean regions of South America, has strong perennial roots, and long interlacing stems which attain considerable height, and produce clusters of small fragrant white flowers. It grows freely in the open air in this country during summer, and is a very ornamental plant.

The Marvel of Peru Family.

(NYCTAGINACEÆ.)

Trees or shrubs, sometimes with strong hooked thorns and climbing, generally with alternate leaves; or herbs, perennial or annual, with thick jointed stems, and opposite leaves. Flowers solitary, or in clusters, often contained within a large leafy green or coloured involucre. Fruit bladder-like, sometimes enclosed within the persistent involucre.

About 100 species compose this family. They are found widely dispersed over the tropics, the pretty genus *Abronia* extending to North-West America. They possess no particular properties.

The family is represented in gardens by the "Marvel of Peru" (*Mirabilis Jalapa*), which has been known in this country for more than two hundred and fifty years; it is said to be a native of both Indies, but this must be considered uncertain. It has large black tuberous roots, which were at one time supposed to produce jalap. This, as well as *M. longiflora*, are handsome garden plants, opening their pretty tube-like various coloured flowers, or properly calyx, in the afternoon, hence called Four-o'clock-flower.

Bougainvillæa spectabilis, *B. speciosa*, and *B. glabra*, natives of tropical America, are rude trailing or climbing ampelids, generally furnished with strong hooked thorns. They are much admired in this country for their showy

flowers, or rather their coloured bracts, which have a handsome appearance.

This family is remarkable in their tissues containing *raphides* in great quantity; in *Pisonia* they lie in bundles like packets of needles, and so compact that their position can be seen with the naked eye by the irregular white markings of the leaves.

The Bloodberry Family.

(PHYTOLACCACEÆ.)

Soft-wooded sub-trees, shrubs or herbs, with alternate simple leaves. Flowers in spikes or panicles. Fruit a fleshy berry with red juice, or sometimes dry.

About 80 species are known of this family. They are chiefly natives of the tropics, some species of *Phytolacca* extending to temperate countries; they are generally acrid.

Poke (*Phytolacca decandra*). A strong-growing herbaceous plant, 3 to 4 feet high, having bunches of dark purple berries, the juice of which resembles red ink. It is a native of the Southern United States, where the plant is used medicinally; the young shoots on being boiled lose their acridity, and are then eaten as a vegetable.

Umbra tree (*Pircunia dioica*). A native of South America, and has now become naturalized in many warm countries, even in the South of Europe, where it becomes a large tree of from 20 to 30 feet high. It has a thick, gouty, soft-wooded stem; the branches are furnished with large dark, broad elliptical leaves, the whole aspect of the tree having a sombre, dull appearance. In the hothouses of this country it soon attains a great height and thickness, and is a rude-growing plant. The juice of its berries is said to be used for colouring wine.

Bloodberry (*Rivina humilis*). A small shrub with soft leaves, native of the West Indies, and is an old inhabitant in the hothouses of this country. It has spikes of white flowers, which are followed by a bunch of small red berries, the juice of which is like blood.

The Garlic Shrub Family.

(PETIVERIACEÆ.)

Small upright-branched shrubs, with simple, alternate, entire leaves, sometimes dotted, and furnished with stipules. Flowers small, in spikes, racemes, or panicles. Fruit small, 1-celled, dry, wedge-shaped with a spiny apex, or a narrow-winged samara.

By some botanists, this small family, consisting of about 10 species, is considered to form a section of *Phytolaccaceæ*, but on account of having a dry samar-like fruit, others separate them—the typical species, *Petiveria alliaceæ*, is a small shrub, very common throughout the West Indies and tropical America. It is well known as the Garlic shrub, the whole of the plant having a strong odour of garlic, which is imparted to beef when the plant has been eaten by cattle. In Jamaica it is called Guinea Hen Weed, guinea fowls being fond of it.

The Buck-wheat Family.

(POLYGONACEÆ.)

Small trees, shrubs, or herbs, perennial or annual, some twining, generally with knotted stems. Leaves alternate, simple, sheathing round the stem, sometimes with a large membrane. Flowers in spiked racemes, axillary or terminal, bisexual or unisexual. Bracts and calyx sometimes large and coloured. Fruit a small, generally triangular, nut.

This family consists of about 500 species, which, with the exception of the tropical genus *Coccoloba* and *Triplaris*, are weedy plants, represented in this country by Dock, Buck-wheat, &c. They are widely dispersed over the earth, even extending to high northern latitudes, but rare in the Southern Hemisphere.

Oxyria reniformis, a small perennial plant with kidney-shaped leaves, is a native of the Arctic regions. It is remarkable for being found on Mount Lebanon, and is supposed

to be the only relic of the once glacial period of that mountain.

Rhubarb (*Rheum palmatum* and *R. Emodi*). Perennial plants, natives of Russia, the range of the Himalaya and western China. From the latter country, large quantities of the roots enter Russia, from which place the best rhubarb comes to this country. The roots of *R. Emodi* find their way to Aleppo, thence to Constantinople, and from there to this country, under the name of *Turkey rhubarb*. There is however, some doubt which species produces the best rhubarb, the Chinese and Tartars not being willing that the plant should be known. But the quality in a great measure depends on the collecting, drying, and transport. *R. palmatum* is much grown in this country for its roots, especially about Banbury. *R. Rhaponticum*, a native of Western Asia, is extensively cultivated for its leafstalk, which is well known as a culinary vegetable, *R. undulatum* and *R. palmatum* being used for the same purposes, as well as made into wine and preserves.

Rhubarb contains numerous crystal bodies, in botany called raphides, which by the aid of the microscope are readily seen in the fresh or cooked leafstalk, having the appearance of numerous needles, and said to consist of phosphate of lime, and it is supposed that the medical virtue of rhubarb is in some way due to them, it being one of our best purgative medicines.

Buckwheat or Brank (*Fagopyrum esculentum*). This is supposed to be a native of Central Asia, where it is extensively cultivated, but it has now become widely spread in most countries. It is largely cultivated in France, Holland, and the United States, for its seeds, which are ground into meal and made into thin cakes. In this country it is used for feeding pheasants.

Polygonum Convolvulus. This is a pest in cornfields, twining round and destroying the crops.

Monks Rhubarb (*Rumex alpinus*). This has been naturalized in some parts of Scotland, and with other large

rooted species of the genus is used as a substitute for rhubarb, but they are of a drastic nature.

Common Sorrel (*Rumex acetosa*). A native of this country. French sorrel (*R. scutatus*), a native of Switzerland. Perennial plants, cultivated in gardens for their leaves, which are acid and are used as culinary herbs.

The genus *Coccoloba* and *Triplaris* are slender almost unbranched trees, or large shrubs, some being twining ampelids. *Coccoloba pubescens*, "Leather Leaf," *C. macrophylla*, and *C. rhæfolia* have large rigid rhubarb-like leaves; they are natives chiefly of the West Indies and tropical America. *C. uvifera* is a small tree or straggling shrub. The flowers are in spikes, and the calyx, when ripe, becoming fleshy, has the appearance of grape berries, and has been called the "sea-side grape;" the bark is astringent and has been used for tanning leather.

THE LAUREL, PROTEA, AND DAPHNE ALLIANCE.

The Oleaster Family.

(ELÆAGNACEÆ.)

Small trees or shrubs, with opposite or alternate leaves, generally covered with scurf scales, of silvery white or brown colour. Flowers small, unisexual or bisexual, axillary, the males in catkin-like spikes. Fruit enclosed within the calyx, becoming a pulpy crustaceous 1-seeded berry.

This small family consists of about 30 species, all widely dispersed over the northern hemisphere, species of *Shepherdia* being natives of North America, and *Elæagnus* of the temperate parts of India, China, and Japan; while *Hippophæ rhamnoides* is widely distributed over Europe and Asia; it is also found on the sea shores of this country, and is called "sea buckthorn;" a fish-sauce is made from the berries, and in Russia they are much esteemed and preserved throughout the winter. They are, however, found to contain a narcotic poisonous principle.

Oleaster (*Elæagnus angustifolius* and *E. orientalis*, now considered as one species under the name of *E. hortensis*). A small stiff-branched tree, growing from 15—20 feet high, having hoary willow-like leaves and small yellow flowers which perfume the air for a considerable distance. It is a native of the South of Europe and Western Asia, forming a scrub in the desert. The berries are dried by the Arabs and made into cakes, and it is supposed to have formed part of the merchandize that the Ishmaelites* carried into Egypt. The berries are known by the name of Trebizond dates.

Buffalo Berry (*Shepherdia argentea*). A low bush, with pretty silvery lance-shaped leaves. It is found abundant in the United States and many parts of North America. The berries are about the size of currants, and form a considerable portion of the food of the Utah Indians.

The Spurge Laurel Family.

(THYMELACEÆ.)

Shrubs or small trees, having tough fibrous bark, with simple, opposite, or alternate broad or heath-like leaves. Flowers solitary, in spikes, round heads, or umbels often contained in a leafy involucrum, which as well as the calyx is generally coloured and corolla-like. Stamens 2–4–8. Pistil 1. Fruit a 1-seeded berry-like drupe or dry nut.

A considerable family of plants consisting of 300 or more species, many being natives of South Africa and Australia; others of tropical America. It is represented in Europe and India by the genus *Daphne*, and in North America by the leather-wood shrub, *Dirca palustris*.

Mezereon (*Daphne Mezereon*). An early flowering shrub, said to be found wild in this country. It is a favourite in gardens, both for its sweet-smelling flowers and pretty berries, which are its only recommendation, they as well as the whole plant being blistering, acrid, and poisonous.

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* Genesis, chap. xxxvii. ver. 25.

Spurge Laurel (*Daphne Laureola*). A pretty evergreen shrub, with poisonous berries, native of this country. Other species of the genus are highly ornamental garden plants; *D. indica* and *D. odora* are prized in the greenhouse for their sweet smell.

Bark Paper (*Daphne cannabina*). A tree native of Himalaya, China, and Japan. By a process of manufacture the bark is made into paper; the sheets, when prepared, vary in size, the largest being about a yard square. It is remarkable for its toughness and durability, and is free from the attacks of insects. Paper is also made in India from the bark of *Edgworthia Gardneri*.

Lace Bark (*Lagetta lintearia*). A small tree, native of Jamaica, growing on limestone rocks, and insinuating its roots in the fissures. It has broad somewhat roundish leaves, and flowers like lily of the valley, the fruit being a pulpy white berry. It is remarkable for its bark, which separates into twenty or more layers, becoming like lace, and was at one time used in Jamaica for many domestic purposes, such as net-caps, bonnets, veils, ruffles, &c.; it is said that Charles II. had a cravat made of it. With care it will bear washing. During the time of slavery, whips and thongs were made of it.

Wickstræmia Indica. A large tree-like shrub, common on the sea shores of tropical Eastern Australia, Fiji, Society and other Polynesian islands. The bark is extremely tough, and is used by the natives for making lines, ropes, and fishing-nets.

Different species of *Pimelea*, natives of Australia and New Zealand, and *Gnidia*, *Lachnæa*, and *Passerina*, natives of the Cape of Good Hope, have long been cultivated in the greenhouses of this country as ornamental plants.

The Wood Aloe Family.

(AQUILARIACEÆ.)

Trees with smooth bark, opposite, alternate, simple leaves and inconspicuous flowers. About 10 species represent

this family, all natives of tropical Asia, the most important being *Aquilaria Agallocha*, a tall tree, having alternate lance-shaped leaves, native of India, Java, and other islands, where it is called Aquila or Eagle-wood. The wood is fragrant, and contains a resinous oil, which is burnt as a perfume in temples. It is supposed to be the aloes, wood aloes, and lign aloes mentioned in several parts of the Bible in conjunction with myrrh, cinnamon, and other sweet-smelling plants; if so, this tree not being a native of Syria, the wood must have been received through commerce with the East; but the passage "As gardens by the river's side, as the trees of lign aloes which the Lord had planted,"* leads to the supposition that it was a tree native of some part of Western Asia, thus leaving doubts as to the true aloes of the Bible.

The Nutmeg Family.

(Myristicaceæ.)

Trees with alternate simple leaves. Flowers small in axillary or terminal racemes, or panicles, generally unisexual. Fruit fleshy, 2-valved, containing a single nut seed covered with an arillus.

Between 30 and 40 species are enumerated in this family. They are chiefly natives of the tropics of India and the Malayan Archipelago; several species are also found in tropical America.

Nutmeg (*Myristica moschata*). A small branching tree attaining the height of 20 or 30 feet; it is extensively cultivated in the Molucca and other islands of the Malayan Archipelago as well as in some parts of India. The fruit is about the size of a walnut, consisting of a rather thick fleshy skin, containing a single nut, which, on the fruit opening, is seen to be enveloped in a red net-like covering which is the

* Numbers, chap. xxiv. ver. 6.

"mace," the kernel being the nutmeg of commerce. *M. fatua* is cultivated in Brazil; the fruit of this is longer than the true nutmeg, and is sold in this country under the name of long nutmegs. *M. otoba* and other species cultivated in the Philippines and Madagascar probably find their way to this country for sale. An oil is extracted from the nuts called oil of mace: the bark stains red. In Malacca and Penang the nutmeg has been extensively cultivated, but during the last few years the trees have been attacked with a disease which has destroyed whole plantations for which no remedy has yet been found.

Myristica sebifera is a large tree 50 to 60 feet high, common in the forests of Guiana, North Brazil, and Panama. By maceration of the nuts in water a solid oil is obtained which is used in candle-making.

The Sandalwood Family.

(SANTALACEÆ.)

Trees or shrubs, rarely herbs; leaves simple, alternate, or nearly opposite, linear, lanceolate, ovate elliptical or small stipule-like, as in the herb *Thesium*. Flowers small in spikes or umbels or solitary, unisexual or bisexual. Fruit berry-like, consisting of a hard shell containing a hard seed.

About 100 species constitute this family. They are widely distributed over both temperate and tropical regions, being represented in this country by the small herbaceous plant called toad-flax (*Thesium linophyllum*), in the East Indies and islands by trees, and in Australia chiefly by shrubs. Few are of importance medicinally or otherwise, except the valuable wood called sandalwood.

Sandalwood (*Santalum album*). A small tree about 25 feet high, and seldom a foot in diameter, with nearly opposite oblong leaves of a light colour. It is a native of various parts of India, particularly Malabar and Coromandel, also Malay, Fiji, and many islands of the Pacific Ocean. According to the size and age of the tree the interior is of a dark or red colour,

and is the valuable part; it is highly fragrant. The burning of incense has from the earliest ages been intimately connected with the religious sentiments of man, being practised by Pagan, Jew, and Christian. In the churches of the latter various kinds of aromatic gum resins are used, while in Pagan temples sandalwood holds the highest rank, pieces of the wood varying in size according to circumstances, being burned before the images of their deities, and the millions of Brahmins and Buddhists, on beholding the smoke incense curling heavenward, presume they have performed their religious duties, and that the perfume smelt by their deity will obtain forgiveness for sins. In Chinese temples joss sticks (candles), made of the sawdust of sandalwood and swines' dung, are kept burning before their idols. On the discovery of sandalwood in the Polynesian islands, shiploads were taken to China and to Europe, so that in many islands the trees have become extirpated, and the chiefs now consider a piece of sandalwood a valuable present to a visitor. Unfortunately the often clandestine cutting down of trees and the unfair dealings with the natives so irritated them against white men, that much bloodshed has on both sides been the result. A case of this kind led to the unfortunate murder of the celebrated missionary the Rev. Mr. Williams and his colleague, at the island Eromango, in the year 1839.

Fancy articles are made of the wood, which are highly esteemed among the Chinese as presents. An oil is extracted and used as a perfume. It is supposed that there are different varieties, the tree in Fiji being considered as a distinct species under the name of *S. Yasi*, the fruit of which resembles a black currant. The Sandwich Island tree is also considered distinct, known under the name of *S. Freycinetianum.*

Sandalwood trees have been supposed by some writers to be the almug and algum trees used in the building of Solomon's Temple, but their fragrance not being mentioned, and the known smallness of the tree, render such views problematical.

Quandang Nut (*Fusanus acuminatus*). A tree attaining

the height of 20 or 30 feet, having a drupaceous fruit, which is used as a preserve, and may be considered one of the few native fruits of Australia worthy of the name of fruit.

Leptomeria acerba and several other species, natives of Australia, are broom-like plants, bearing pulpy berried fruit called the native currant.

Santalaceous plants have been found difficult to cultivate in this country.

The Australian Sassafras Family.

(MONIMIACEÆ.)

Evergreen aromatic trees or shrubs, with opposite, entire, or toothed leaves, and small inconspicuous, unisexual flowers. Fruit consisting of 1 or several 1-seeded nuts, enclosed in the large tubular calyx.

About 50 or more species are described as belonging to this family. They are chiefly natives of South America, a few, of the tropics of the eastern hemisphere, also of Australia and New Zealand.

Tasmanian Sassafras Tree (*Atherosperma moschata*). A native of Mount Wellington in Tasmania. It attains the height of from 100 to 150 feet, and a diameter of 2½ feet. Its aromatic bark has been used as a substitute for tea; it yields a fragrant essential oil.

Australian Sassafras Tree (*Doryphora Sassafras*). A native of New South Wales, and equal in magnitude to the preceding.

New Zealand Sassafras (*Laurelia Novæ Zelandiæ*). A large handsome tree of New Zealand, of from 100 to 150 feet in height, having buttresses 15 feet in diameter. *L. sempervirens*, also a large tree similar to the last, native of Chili and Peru. Its fruit being aromatic, it has obtained the name of Peruvian nutmeg, but is of no value.

Boldoa fragrans. A small tree with broad entire bay-scented leaves, is also a native of Chili, and, with the above named species, is grown in the greenhouses at Kew.

The Laurel Family.

(LAURACEÆ.)

Large or small (generally) evergreen trees or shrubs, having simple, alternate leaves, often with a gland or pore at their base, generally firm, and often shining. Flowers in panicles or umbels, or crowded spikes, inconspicuous, generally bisexual. Fruit a drupe, sometimes berry-like.

This family consists of nearly 500 species. They are widely distributed, chiefly throughout the tropical and temperate regions of both hemispheres, extending from North America to New Zealand and Japan. Many are of great importance for their timber; they also yield various drugs, all containing an aromatic principle, which is obtained in the form of oils or a fatty matter, and locally used as remedies for many complaints.

Bay (*Laurus nobilis*). A native of the South of Europe, where it attains a considerable height, even 40 or 50 feet. It is well known in this country, but is often killed to the ground in severe winters, which circumstance gives it the appearance of a bushy shrub. The leaves are used for flavouring custards, puddings, &c. Figs imported to this country are also packed in them, and they are said to be the leaves with which ancient heroes were crowned, hence the phrase, "crowned with laurels." This must not be understood as the common shrub called Cherry Laurel, which belongs to the *Cherry Family*.

American Sassafras (*Laurus Sassafras*). A native of North America, is common in the United States, where it attains a considerable size, forming a large head of horizontal branches, densely furnished in summer with large, broad, oblong leaves, often lobed. It is rare in this country. A tree at Kew, one hundred years old, has attained the height of about 40 feet. Its bark is used medicinally as a tonic, and is also made into a drink called saloop. Its fruit is a small black drupe, from which a perfume oil is obtained.

In California, *Oreodaphne Californica* is a large tree. It has several names; such as Spice-bush, Balm of Heaven, Cajeput tree, &c., which shows it to be a tree of repute as regards its medicinal virtues; its leaves are pungently aromatic. It has been introduced to this country under the name of *Laurus regalis*.

Canary Laurel (*Laurus Canariensis*), Royal Bay (*Laurus Indica*), are fine trees, natives of Madeira and the Canary Islands, having large shiny leaves; the timber of the latter is used as a kind of mahogany.

Til (*Laurus fœtens*). A tree, native of Madeira. It has broad, shining leaves; its timber is remarkable in having a most fœtid odour which it retains for years; and in that respect has a companion in the celebrated "Stink wood tree" of the Cape of Good Hope (*Laurus bullata*).

Greenheart Tree (*Nectandria Rodiœi*). A large tree, native of Guiana, often having a clear stem of 40 or 50 feet in height, with a diameter of between 2 and 3 feet. Its timber is highly valued for shipbuilding, and is imported from Demerara for that purpose.

Another Greenheart tree is *Laurus chloroxylon*, a native of Jamaica. It is a lofty straight tree of very uniform girth, having oval, elliptical, three-nerved leaves. The wood is very hard, resisting the power of the axe; it is used for many purposes in sugar works and machinery. From one tree a straight beam has been obtained 40 feet in length and 10 inches square.

Alligator Pear, also called Avocado Pear (*Persea gratissima*). A native of the West Indies and tropical America. It is a small tree, attaining the height of 20 or more feet, and produces a pulpy oblong fruit about the size of a large pear. It is now common in the Mauritius and other hot countries, where, as well as in the West Indies, it is much esteemed as a dessert fruit.

Cinnamon (*Cinnamomum Zeylanicum*). A small tree, with alternate, oblong, lance-shaped leaves, having strong veins passing from the base to the apex; it is extensively culti-

vated in Ceylon for its bark, which rolls up in drying, like pipes about the size of the finger or larger, and forms the cinnamon of commerce.

Cassia bark (*Cinnamomum cassia*). This is similar to the last, but has blunter leaves. Cassia buds are the young buds of this and some allied species. Other species also furnish aromatic barks which are used as substitutes for cinnamon.

That cinnamon and cassia were known to the Israelites, appears evident from the fact that they formed two of the spices* ordered to be used in the preparation of the perfumes and incense for the altar of the tabernacle. From this it must be inferred that a trade in spices was carried on through Arabia with India and Ceylon.

Camphor (*Camphora officinarum*). A tree, native of China and Japan. It yields the principal camphor of commerce, the greater quantity coming from the island of Formosa. It is obtained by boiling the wood of the tree in water, when the camphor is deposited.

The Dodder Laurel Family.

(Cassythaceæ.)

Twining pale-coloured plants, their seeds first germinating in the earth, but soon becoming parasitical on trees and other plants. Destitute of true leaves, which are represented by scales, their whole habit being similar to European Dodders, and although thus differing extremely in appearance from the Laurel Family, they nevertheless agree in the character of their flowers, which are in clusters. The family consists of about 6 or more species, all widely distributed throughout the tropics. They are of much stronger growth than dodder, even to that degree that they as readily destroy trees as the dodder destroys the plant on which it grows.

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* Exodus, chap. xxx. ver. 23.

The fruit is berry-like, formed of the succulent calyx, and is in some places used medicinally.

The Protea Family.

(PROTEACEÆ.)

Large and small trees or shrubs with alternate, rarely opposite, single lobed, winged leaves, much divided ; generally harsh and prickly, varying from broad elliptical to narrow, like needles. Flowers in spikes or heads, compact, or loose and panicled; bisexual. Calyx 4-parted, or 4-cleft, each lobe with a concave apex bearing a sessile stamen (anther). Pistil simple. Fruit consisting of a 1—2 or many seeded follicle, separate or in compact heads, forming hard woody cones.

This remarkable and distinct family of plants consists of about 1000 species, almost entirely confined to the southern hemisphere, the great regions being South Africa, Australia, and Tasmania, where the smaller sorts form harsh scrub. A few are found in New Zealand and Chili, and are represented in tropical America by the beautiful tree genus *Rhopala*, and in the Malay Islands by the genus *Helicia*. It is singular that such an extensive family should produce no products of importance to man. The larger trees are, however, valued for their beautiful mottled wood, which is used in cabinet work. They have long been much admired as botanical curiosities, both in this country and on the Continent.

Silver Tree (*Leucodendron argenteum*). A small tree with beautiful silvery lance-shaped leaves, native of Table Mountain, Cape of Good Hope. Its vicinity to Cape Town has led to its almost complete extirpation for firewood.

Silky Oak (*Grevillea robusta*). A native of Queensland, and probably one of the loftiest trees of the family; it attains the height of from 50 to 150 feet, with a diameter of from 6 to 8 feet; its timber is valued. A plant introduced at Kew in 1826, has attained a large size,

and with its much divided silky leaves presents a strong contrast to the more humble species of the genus, which consist of small shrubs, with willow, holly, box, or juniper-like leaves, producing pretty spikes of flowers.

Another large tree of Queensland, *Stenocarpus Cunninghamii*, is valued for its hard wood; it has smooth deeply lobed leaves, a foot or more in length. It was introduced at the same time as the preceding, and grows and flowers freely in the greenhouse.

Knightia excelsa is a large tree, native of New Zealand, attaining the height of 100 feet, and is valued for its timber; it has simple, oblong, toothed leaves.

Waratah (*Telopea speciosissima*). A native of New South Wales. It has slender erect stems, simple toothed leaves, and a splendid flower, similar in size and colour to a double red Camellia. About thirty or more years ago it was a great favourite with amateurs, but being difficult of cultivation, it is now seldom seen.

Woody Pear (*Xylomelum pyriforme*). Also a native of New South Wales. A small tree with opposite leaves, being remarkable for its fruit, which bears the exact resemblance and size of an ordinary pear, but is attached by the broad end. It consists entirely of a hard woody substance, difficult to cut; when ripe it splits lengthwise and contains a flat winged seed.

Avellano Nut (*Guevenia Avellano*). A small tree with winged leaves, native of Chili, and the wild almond (*Brabejum stellulatum*), native of the Cape of Good Hope, are the only two plants of the family that produce seeds of sufficient size to be worthy of the name of eatable nuts.

A new genus has lately been discovered in Queensland, named *Macadamia* (*M. ternifolia*), a large tree with stiff spiny leaves. Fruit a follicle containing a very hard nut-seed about the size of a marble, which is said to be good to eat. It is allied to the genus *Helicia*.

The numerous species of *Banksia* and *Dryandra* are inte-

resting plants, and have long formed an important feature in the Kew collection; *B. australis*, *B. compar*, *B. integrifolia*, *B. Solandri*, and *B. serrata*, attaining the height of from 15 to 20 feet, several being forty years old, while two plants of *B. repens* are upwards of sixty years of age.

A few years ago the Kew collection of Proteaceæ amounted to 155 species. For many years plants of this family were rare in this country, but forty-five years ago the Clapton Nursery became, and continued for many years, famed for its large stock of Australian Proteaceous plants; they were also plentiful in private collections of this country, as well as on the Continent, but the taste for show-flowers has caused them to be superseded, and now proteaceous plants are rarely to be seen.

In Australia the Banksias are called "Honeysuckle trees," on account of the great quantity of honey contained in their flowers, which is also the case with *Protea mellifera*, and others of the Cape of Good Hope.

The Sarcocol Family.

(Penæceæ.)

Small shrubs with opposite, distant or closely imbricate short leaves. Flowers solitary or in terminal heads, red or pale yellow. Calyx a shallow 4-lobed cup, with bracts at its base. Stamens 4 or 8. Fruit a 4-celled capsule.

This family consists of about 20 species, natives of South Africa, the most interesting being *Penæa Sarcocolla*, which is said to yield the gum sarcocol, but there is no evidence to show that it produced the sarcocol of the ancients, which was famed for healing wounds.

THE SPURGEWORT ALLIANCE.

The Spurgewort Family.

(Euphorbiaceæ.)

Large woody or succulent trees, shrubs, frutlets, or herbs, many annual and weedy, abounding more or less in milky

or watery juice. Leaves opposite, or alternate, entire or palmately lobed; in succulent species absent or nearly so. The inflorescence and structure of the flowers are various, in some a number being contained in an entire or many sepal-like involucre, or highly coloured bracts, or each flower distinct, with or without a true calyx, sometimes with corolla, monœcious or diœcious. Fruit a 3 or many valved capsule, each cell containing a single seed; rarely fleshy. Various in different genera.

This extensive family contains not less than 3000 species, all being widely distributed over the earth. In temperate countries they are chiefly herbs; in Africa, particularly in the south and east, they have succulent stems, often leafless, some becoming large hard-wooded trees. Within the tropics they are large leafy trees, and in America assume their grandeur. In this country the family is represented by about 14 species of *Euphorbia* and *Mercuralis*, which are annuals and perennials, also by the well-known box tree. With few exceptions an acrid principle pervades the family.

Cassava (*Manihot utilissima*) (bitter) and *M. Aipi* (sweet), are slender-growing woody-stemmed plants, having lobed or palmate leaves. They are extensively cultivated in tropical America and the West Indies for their large fleshy roots, which are similar to parsnips, and contain a great quantity of farina, which is obtained by maceration and filtering in water, and on being dried is the cassava so much valued as an article of food. Tapioca is the starch which settles from the water used to wash the cassava meal, which is afterwards dried and granulated on hot plates. The roots of the bitter cassava in their raw state are highly poisonous, those of the sweet being wholesome.

An inebriating drink is also made from cassava bread by the Indians, called "piwarrie;" it is made by the women, who chew the cake, which, after being well masticated, is ejected into a vessel, water being then added, and after fermentation it is boiled, and when cool is ready for use, the taste being said to resemble ale. However repugnant the

process of manufacture may be to Europeans, it is well known to have been drunk by several eminent travellers, one saying, "In my opinion the piwarrie is very agreeable and wholesome, for I drank it in large quantities at the different Indian settlements I visited."

Castor oil or Palma Christi (*Ricinus communis*). Originally supposed to be a native of India, but now widely spread over the warm regions of the earth. In this country it makes a handsome summer plant, having an erect stem from 4 to 5 feet high, bearing large broad lobed leaves, the whole being of a rusty dark appearance. In warmer countries, such as the south of France, it becomes a soft-wooded tree. The bruised seeds afford the well known castor-oil, the supply for this country being derived principally from India. The leaves have lately come into repute as food for a species of silkworm, and in some parts of Germany it is grown for that purpose.

Croton Oil (*Croton Tiglium*). A native of India. The powerful oil used in medicine called "croton oil" is extracted from its seeds.

Pinhœn Oil (*Jatropha Curcas*). A small tree attaining the height of 20 feet, having soft spongy wood and entire or lobed leaves. It is a native of tropical America, and is now cultivated in all hot countries for its seeds, which yield an oil analogous to that of castor-oil, but of a drastic nature; it is used for many purposes. The seeds are nutty and pleasant to eat, but when eaten to excess produce serious consequences; a few years ago several children died at Bristol through eating them.

Stinging Bush (*Jatropha stimulans:* sometimes called *J. horrida*). A small straggling soft-wooded shrub with lobed leaves, covered as well as the younger parts of the wood with stiff hairs like small needles, which sting fearfully and are much dreaded by the natives; it causes an intense burning pain, with swelling, which is not confined to the part stung but sometimes spread over the body. A plant at Kew stung the writer on the wrist, and in a few minutes the poison extended up the arm and the upper part of the body,

the lips became swollen, and the whole of a livid red, fainting coming on in less than ten minutes, on recovering from which, the whole sensation went off as fast as it came on. The general health was, however, impaired for several days.

Gum Euphorbium (*Euphorbia officinarum*, *E. antiquorum*, and *E. Canariensis*). Plants with succulent stems, almost leafless, natives of Africa and India. Their milky juice is highly poisonous, and when dried forms the drug called gum Euphorbium.

Cattimandoo Gum (*Euphorbia Cattimandoo*). A native of India, and very like *E. trigona*. It is from 8 to 10 feet high, and yields a gum little inferior to gutta-percha.

Zebra Poison (*Euphorbia arborea*). A tree, native of South Africa. Its milky juice is highly poisonous, whole herds of zebras having been killed by branches of it being placed in the water which they drank. It is also used for arrows.

Euphorbia Tirucalli, *E. piscatori*, and *E. pendula* are also highly poisonous; a small portion placed in water kills fish very quickly. The most common example in this country is *E. heliscopia*, generally called "Little Goody," the milk of which is employed by rustics for removing warts. The floral bracts of several species are very showy and are favourites in cultivation, especially *E. splendens*, a native of Madagascar, *E. punicea*, of the West Indies, as also the well-known *E.* (*Poinsettia*) *pulcherrima*, native of Mexico, which is an ornamental plant in winter. Care is, however, necessary in pruning and handling them, serious consequences having occurred through the juice entering the circulation by cuts or in other ways.

False Caper (*Euphorbia Lathyrus*). A strong-growing milky perennial plant from 2 to 3 feet high, having willow-like leaves. It has received the name of caper bush. The fruit is 3-celled and green, and has been used by the ignorant for capers, but they are dangerous if many are eaten.

Manchineal Tree (*Hippomane Mancinella*). This, like the

Upas tree of the East, is the celebrated poison tree of tropical America; it grows to the height of from 40 to 50 feet, and is generally found near the seashore. The leaves are simple, of an elliptical form, and shining, 3 to 4 inches in length. The fruit is of a yellowish green colour, and very tempting to the eye, but when bitten its acrid juice is very burning. Many wonderful stories are told of the virulent nature of this tree, even that it causes ill effects to persons lying under its shade; its milky juice is highly acrid and blistering to the skin, and has caused blindness by the hands coming in contact with the eyes after the plant has been handled.

Sand Box Tree (*Hura crepitans*). A native of the West Indies and many parts of tropical America. It forms a very large tree, and has long been cultivated in the hothouses in this country. Instances have been known of the juice of this plant causing fatal injury to the eyes. The fruit is very curious, being of a circular form, consisting of from 12 to 15 valved cells which give it the appearance of a wheel about 3 inches in diameter, each cell containing a single flat seed. It is often kept as a curiosity, but with over-heat or dryness bursts with a report as loud as a pistol, spreading its seeds and valves to a distance of 15 feet.

Tallow Tree (*Stillingia sebifera*). A native of China, where it is, as well as in India and some warm parts of America, extensively cultivated. It is a small tree with rhomboid tapering leaves, and a 3-celled capsular fruit, each cell containing a single seed thickly coated with a white greasy substance that yields tallow, of which candles are made, and has also been used in this country in the manufacture of soap and as a substitute for linseed oil, also for dressing cloth and burning in lamps.

Candle Nut (*Aleurites triloba*). A tree about 30 feet high, having simple lobed leaves, native of most warm countries throughout India, Malay, Japan, and the whole of the islands of the Pacific Ocean, where it is cultivated for the sake of its fruit, which is about $2\frac{1}{2}$ inches in diameter, and contains a hard nut that yields a large quantity of oil which is exten-

sively used in many of the Polynesian islands. In the Hawaiian islands the entire kernels are strung on a stick and lighted as candles; this is also done in India, where the oil is much used. It is imported to this country for candle-making, and is said to be equal to sesame or rape oils.

Caoutchouc, better known by the name of indiarubber, is the thickened milk sap of trees, principally of the bread-fruit, mulberry, dog's-bane, swallow- and spurge-wort families, the original and still greatest quantities being obtained from several species of *Siphonia*, a genus of the latter family. They are lofty trees, natives of North Brazil, Guiana, and different parts of Central America, *S. elastica* being the best known. It is a tree attaining the height of 50 to even 100 feet, and has smooth trifoliate leaves similar in size and form to those of the scarlet-runner. The flowers are inconspicuous, unisexual, and borne in loose panicles. The fruit is a 3-valved capsule bearing 3 nut seeds. It is found throughout the lower regions of the Amazon, and is abundant on many islands of that great river. During the wet season these islands are flooded, but as soon as the water subsides they are tenanted by numerous Indians and their families, whose occupation is the preparation of caoutchouc. The sap is obtained by making deep vertical and slanting incisions in the bark of the trees, the sap flowing from the wounds follows their downward course, and is caught in vessels at the lower end of the vertical incisions. By exposure to the air the sap thickens and becomes like a creamy paste; a coating of it is then laid on clay moulds, which are suspended over slow fires. When the first coat is dry a second is added, and so on coat after coat till the required thickness is attained. When the drying is completed the mass is removed from the mould, and is the raw indiarubber of commerce, its blackness being partly owing to the smoke it absorbs whilst drying, and partly by exposure to the air. In Nicaragua and other parts it is made into flat cakes and hung up to dry without artificial heat.*

* This is chiefly obtained from *Castilloa elastica* (page 224).

The original use of this substance by the Indians was to make water vessels for domestic use, and for that purpose it was dried on moulds in the form of bottles, in which form it was first brought and still comes to this country.

Our earliest knowledge of this important article dates from the discovery of America. We learn from history that the natives of St. Domingo were seen by Columbus playing games with elastic balls, and that the Mexicans had shoes and clothes made of an elastic substance. The first accurate information of this substance was from M. Condamine, a French naturalist and traveller, in 1735. About 1750 specimens of it appear to have been received in Paris, and in 1772 it is recorded as having been sold in London. It is described by Dr. Priestley as an excellent article for rubbing out pencil lines from paper, and coming from the "Indies" it became familiarly known as "indiarubber;" for fifty years from the above date it was scarcely used for any other purpose. Experimentalists were, however, not idle, and before the end of the century it was employed in rendering woven fabrics waterproof; but on account of its stiffness in cold, and its stickiness in hot weather, it did not meet with patronage. In 1820 it was, however, more successful, being used in making articles of elastic dress, such as stockings, braces, garters, bands, and the like; three years later it was again used to make waterproof clothing, which attained more success than the first, being less influenced by changes of temperature.

In 1842, being 350 years from the time it was first seen by Columbus, the grand discoveries were made that "indiarubber" possessed the power of absorbing sulphur, which rendered it unaffected by extremes of ordinary temperature even to that of boiling water, and that it could be made to assume any degree of texture, from a thin elastic membrane to the rigidity, and even to the hardness and solidity of iron. In its sulphuretted state it received the name of vulcanized indiarubber; this discovery has led to many patents being obtained for its use in the manufacture of all kinds of useful

articles, from the transparent membrane of the toy balloon to the wheels of carriages and machinery. Go where we will some application of caoutchouc is almost sure to meet the eye, and its uses are continually on the increase. Rich and poor, young and old, all share in the benefits derived from the extended use of this remarkable material; and it may be well said that no vegetable substance has been more prolific for useful appliances in domestic economy. As might have been expected, so many applications have led to an increasing demand for the raw article, and it is worthy of consideration whether the supply from the present American localities can be continued, on account of the Indians in some places destroying the trees to obtain the milky sap, so that in time the *Siphonia*, called by the Brazilians "*Seringo* trees," may, like the *Cinchona* trees in the same country, become extinct. It is therefore desirable that the tree should be introduced into other countries, such as our West India colonies, Sierra Leone, Mauritius, Ceylon, and India; and judging from a plant grown at Kew, it seems to be a tree of robust and quick growth. As already shown, the caoutchouc is also obtained from different species of Ficus, natives of the East Indies and other parts.

African Teak (*Oldfieldia Africana*). A large tree, native of Sierra Leone, with digitate leaves and a dry 3-valved capsular fruit. The wood was introduced in 1819 for ship-building purposes, but was found too heavy for general use; it is adapted, however, for steam vessels, as it stands a great degree of heat. It is also called African Oak.

Cascarilla Bark (*Croton Eleutheria*). A small tree, native of the Bahamas, from whence is imported the well-known Cascarilla Bark, which is used as a bitter tonic.

Malambo Bark (*Croton Malambo*). A shrub, native of Venezuela and New Grenada, growing to the height of about 4 feet, having a yellowish somewhat corky bark, highly aromatic, like *Calamus aromaticus*. It is highly valued for medicinal purposes, and is even said to have proved useful in the treatment of cholera. In the United States it is said to

be largely used for mixing with ground spices. The aromatic character seems to indicate that this plant belongs to some other family than the present.

Agallocha (*Excœcaria Agallochum*). A small tree, native of India, generally found growing near the sea, abundant on the sunderbunds of the Ganges. Its milky juice is very acrid, blisters the skin, and is much dreaded by woodcutters. The wood is used for making charcoal, but the smoke is injurious to the eyes. It is also native of some of the Polynesian islands, where it is as much dreaded by the natives as the Manchineal of America. In Fiji it is employed for the cure of leprosy, its mode of application being very singular. The body of the patient is first rubbed with green leaves, he is then placed in a small room and bound hand and foot, when a small fire is made of pieces of the wood of this tree, from which rises a thick smoke; the patient is suspended over this fire, and remains for some hours in the midst of the poisonous smoke and under the most agonizing torture, often fainting. When thoroughly smoked, he is removed, and the slime is scraped from his body; he is then scarified and left to await the result. In some cases he is cured, but frequently the patient dies under the ordeal.

Hyæna Poison (*Hyœnanche globosa*). A tree-like shrub, native of South Africa. It attains the height of from 8 to 10 feet, and has smooth, entire leathery leaves. The fruit is highly poisonous, and is rubbed over flesh bait for the purpose of destroying hyænas and other beasts of prey. It is said to contain strychnine.

Kokra Wood (*Scepa* (*Lepidostachys*) *Roxburghii*). A tree with simple laurel-like leaves, native of India. The wood is hard, and is used for many purposes.

Box Tree (*Buxus sempervirens*). A well known evergreen tree or shrub, native of Europe and temperate Asia, and supposed to be indigenous in this country on Box Hill in Surrey. It attains the height of from 10 to 30 feet, and has a stem from 8 to 10 inches in diameter. The wood is hard and close grained, takes a fine polish, and is valued for

wood engraving, turnery, making mathematical instruments, &c. The chief supply comes from ports in the Mediterranean and Black Seas. The box, which forms the edges of garden walks, is a dwarf variety of *B. sempervirens*. There is a doubt if the "Box Tree"* mentioned in Scripture is the same as this plant, or a species of Pine, but there is some reason to suppose that the "benches made of ivory"† were of boxwood.

Turnsole (*Croton* (*Crozophora*) *tinctoria*). An annual, 6 to 12 inches in height, native of the south of Europe. In France and other parts it is cultivated for the sake of a dye called "turnsole," which is obtained by bruising the whole plant.

Another kind of dye is obtained from *Rottlera tinctoria*, a tree common throughout the Madras Presidency. It consists of a powder which covers the capsules, and is scraped off when ripe; it is of a red colour, and forms a considerable article of trade at Hyderabad and other parts of the Circars. It dyes silk a beautiful orange colour, also, by a different process, scarlet. The powder has been introduced into this country as a vermifuge, and is known under the name of *Kamala*.

The Crow-berry Family.

(Empetraceæ.)

Shrubs with heath-like leaves and inconspicuous flowers. The family consists of 4 species, represented in Europe by the "Crow-berry," by some called "Crake-berry" (*Empetrum nigrum*), a shrub not exceeding a foot in height, growing abundantly in the north of Scotland, where its berries form a considerable portion of the food of the "moor-fowl;" they are said to be wholesome, and eaten by the Laplanders. In Siberia a drink similar to lemonade is made from them. Allied to it is *Corema* (*Empetrum*) *lusi-*

* Isaiah, chap. xli. ver. 19; and chap. lx. ver. 13.
† Ezekiel, chap. xxvii. ver. 6.

tanicum, native of Portugal, and represented in North America by *Ceratiola ericoides*, a heath-like shrub 4 to 6 feet high, and in South America by *Oakesia*.

The relationship of the following families has not been well ascertained.

The Pitcher-leaf Family.

(NEPENTHACEÆ.)

Fruticuls (generally climbing) with alternate sessile leaves, the lower part flat, from a few to 18 inches in length, and 2 to 6 inches in width; the apex suddenly contracted into a tendril or hook, bearing an appendage in the form of a pitcher or vase furnished with a lid, which is at first closed but ultimately opens as though by a hinge. The vase varies in size from 2 to 12 inches in length, and from 1 to 6 inches in diameter, and contains a natural fluid. Flowers diœcious, in terminal racemes. Fruit a many-seeded capsule.

Natives of Ceylon, Malacca, Java, Borneo, and other eastern islands. The number of species does not probably exceed a dozen, eight of which have been introduced and grown at Kew.

Pitcher-plant (*Nepenthes distillatoria*), a native of Ceylon, has long been known in the hothouses of this country. It sometimes attains a great length; a plant at Kew attained the length of between 30 and 40 feet. During the last twenty years other species have been introduced, one of the finest being *N. Rafflesiana*, a native of Singapore and Java. It has large fine crested pitchers, but is now far surpassed in size by *N. Rajah*, a native of Borneo, the pitchers of which are 12 inches in length and 6 inches in diameter, holding nearly a quart of water. Many of the pitchers bear an exact resemblance to a water-jug with a lid. Insects are attracted by the water they contain, and get immersed in it, where they die and become putrid, which is considered essential to the well-being of the plant. These plants have no useful properties,

and are only grown as curiosities; as such they are highly prized in this country.

The Birthwort Family.

(ARISTOLOCHIACEÆ.)

Small trees or shrubs, generally climbing; or gemmæ-corms. Leaves alternate, round, elliptical, cordate, or lobed at their base, some with leafy scale-like stipules. Flowers axillary, solitary, bisexual, on long stalks or on very short stalks, and rising direct from the stem. Calyx (corolla-like) tubular, straight or bent, with a regular limb, or very irregular, consisting of a large flaccid lip sometimes with a spur. Stamens (anthers) 6—12 or 24, sessile, seated at the base of the tube, adhering to the pistil, which is short, rayed, or circular, and button-like. Fruit a succulent or dry membranous capsule containing thin flat seeds.

Nearly 150 species constitute this family, the arborescent and climbing ones being chiefly natives of the tropics. They abound in America, where with *Passiflora* and *Bignonia* they form an interminable interlacing of the forests, causing them to appear as if the whole were tied together with ropes. A few herbaceous species are found in distant localities over the temperate northern hemisphere. On account of the peculiarities of structure both in flowers and wood, the relationship of *Aristolochia* is not well defined. There is only one floral appendage, which, although extraordinarily developed, and assuming the appearance of a corolla, is nevertheless described by botanists as a perianth (calyx). It is probable, however, that it is a true corolla, and that the calyx is suppressed, its place being shown by a small disc round the base. The structure of the stems of the woody species is also peculiar in having no concentric circles, but separating lengthwise in wedge-shaped plates.

Considerable medicinal qualities are ascribed to some of the species, which are bitter, tonic, and stimulating; but its chief fame is its supposed efficacy in the cure of snake-bites.

In tropical America various species of *Aristolochia*, as well as other climbing plants, receive the name of "Guaco," being a name for plants used in the cure of snake-bites; and it is even said that the Indians have the power of taking hold of the most venomous snakes without injury to themselves, by being what they call "guaconized," which is, having taken guaco. The European species, *A. longa* and *A. sempervirens*, are said to have the same virtues, being the plants used by jugglers for charming snakes.

Snake Root (*Aristolochia serpentaria*). A native of the United States, furnishes the drug called "Serpentaria," which was once considered as a remedy in snake-bites, but not now much valued.

Aristolochia ringens, a native of Brazil, is also used for the same as the preceding, as well as for other medicinal purposes. The root has a very disagreeable smell, like that of rue, and a strong, bitter, aromatic taste.

Aristolochia Sipho. A hardy creeper, growing to a great length, native of North America. It has large heart-shaped leaves, and flowers bent down like short tobacco-pipes. Several remarkable species are cultivated in hothouses, such as *A. grandiflora*, *A. gigas*, *A. labiosa*, *A. ornithocephala*, and others, natives of tropical America. In these the appendage or lip of the flower is large, hanging loose from the tube, generally of a mottled dingy colour, looking like dirty rags. In *A. grandiflora* it is 1 foot in length, from which hangs a string-like tail 1½ to 2 feet in length; it has the appearance of a cowl or cap, and is said to be worn as such by the Indians. This is, however, far surpassed by *A. Goldieana*, a native of West Tropical Africa, having flowers above 2 feet in length, and about 1 in breadth. It differs from the American species by having 24 stamens. These species when in flower emit an odour like carrion, so strong as to be almost intolerable in a hothouse, but they are nevertheless valued as creepers and for the oddity of their flowers.

Asarabacca (*Asarum europæum*). A native of this country.

It is a low herbaceous plant with creeping stems, producing numerous kidney-shaped leaves about 6 inches high, growing compactly together; the flowers are produced on short stalks hid amongst the leaves, and of a brown colour. It was once held in medicinal repute by herbalists, but is not now much used.

The Garryad Family.

(GARRYACEÆ.)

A family consisting of 6 species of shrubs, with opposite leaves and unisexual catkin flowers.

Garrya elliptica. A handsome ornamental, hardy, bushy shrub, native of California, and attains the height of from 4 to 5 feet. *G. Jamaicensis* is a lance-leaved shrub, native of Jamaica, and is grown at Kew.

The wood of this family is destitute of concentric zones, which with other characters renders its position in the system uncertain. Allied to *Garryaceæ* is the family *Helwingiaceæ*, which is founded on a small shrub (*Helwingia ruscifolia*), having opposite leaves and small fascicles of unisexual flowers growing on the midrib of the leaves. It is a native of Japan, and has been introduced at Kew and found hardy when growing under the protection of a wall.

The Chloranth Family.

(CHLORANTHACEÆ.)

This family consists of about 12 or more species of herbs or fruticuls, with opposite simple leaves and small axillary panicles of inconspicuous flowers of anomalous structure, which renders their affinity not well determined. The best known is *Chloranthus inconspicuus*, a native of China, having leaves similar to the tea plant, but of a softer texture and paler colour, which are said to be used in imparting a perfume to tea, but this appears doubtful, as the plant has no perceptible odour, and if used it is probably only to increase the bulk of the tea.

The Pepper Family.

(PIPERACEÆ.)

Erect or climbing shrubs or fruticuls, often with swollen joints. Leaves simple, alternate, opposite, or in whorls, often fleshy and longitudinally veined, sometimes with stipules. Flowers small, usually in tail- or catkin-like spikes, without calyx or corolla. Stamens 2. Pistils 3. Fruit small, berry-like, 1-seeded.

The Pepper Family are almost entirely confined to tropical regions and consist of above 500 species, a great number of them being found in America, those with succulent leaves growing in dry rocky places, while others are epiphytal climbers. They contain a pungent and aromatic property, of which pepper may be considered the type.

Modern botanists have classified them under a number of different genera, but they are here noticed under the old generic name of Piper.

Pepper (*Piper nigrum*). A native of the East Indies, where it is, as in most tropical countries, cultivated. It is an epiphytal plant, climbing and clinging to trees like ivy, having heart-shaped leaves about the size of ivy leaves, producing flowers in spikes followed by berries like currants, that are first green, but after being gathered and dried become black; such being the black pepper of commerce.

White pepper is produced from the same berries divested of their skin by washing and rubbing. The kinds cultivated in Ceylon, Jamaica, and Trinidad have been grown at Kew, and although all are of the same habit of growth, yet they appear sufficiently distinct to be entitled to the rank of species, which may probably be the reason of the different qualities of pepper. It is a well known stimulant, and is mentioned by Theophrastus as being known to the Greeks and Romans; Pliny speaks of it as commanding a high price.

Long Pepper (*Piper Roxburghii*). The flower spikes of

this plant are dried, and form the long pepper of commerce. Dutch long pepper is said to be furnished by other species, especially by *P. officinarum*. These are much cultivated in the Indian Peninsula.

Betel Pepper (*Piper Betel*). This in general grows in the same manner as *P. nigrum*, and is extensively cultivated throughout Lower India and the Malay Islands for the sake of its leaf, which is chewed with the betel nut and lime, a custom general throughout tropical Asia.

Kava or Ava (*Piper methysticum*). A knotted, erect, soft-stemmed shrub, 8 or 9 feet high, with heart-shaped dark green leaves. It is a native of many of the islands of the Pacific, where it is in common use for making a stimulating and intoxicating drink, prepared by chewing the root and ejecting the saliva into a family bowl, varying in size according to the rank and number of the parties. After a certain quantity of juice is obtained, water is added; it is then well stirred and strained, when it is fit to drink, and the whole party partake of it. The punch-ladle, as it may be called, is a bunch of tow (fibre of the paper mulberry), which is dipped into the liquid and then squeezed into the drinking-cup. The late Captain Sir Everard Home informed me that he was a guest at a royal banquet, and witnessed the whole operation of preparing the drink. It is now repudiated in some of the civilized islands.

A royal bowl with the tow ladle from the island of Tongataboo may be seen in the Museum at Kew; it is in the shape of a boat, 4 feet 6 inches long, 2 feet 2 inches broad, and 1 foot 8 inches deep.

Mastico (*Piper elongata*). An erect-growing species, with lance-shaped rough leaves, native of tropical America. It is in great repute for stanching the bleeding of wounds, being known in South America by the name of Soldier's Herb; it was at one time considered so useful that large quantities of it were sent to India. This species, with many others, has been long cultivated at Kew.

The Lizard Tail Family.

(Saururaceæ.)

Cæspitose, perennial herbs, with or without radical leaves. Stems about a foot in height. Leaves alternate, or 1 only, generally heart-shaped, with sheathing stipules. Flowers terminal, in short or long tail-like spikes, with or without a corolla-like involucre round the base of the spike; without corolla or true calyx. Fruit a fleshy berry. Seeds few.

Of this family about half a dozen species are known. They are natives of the temperate northern hemisphere, growing in marshes and watery places. Lizard Tail (*Saururus cernuus*), native of Virginia, has been long cultivated at Kew, as also *Houttuynia cordata*, native of Japan, the roots of which have a strong, unpleasant tidal-mud or fishy odour.

Anemiopsis Californica. A native of California and Mexico, has also been recently introduced. It differs from the preceding in having radical leaves; they are used as domestic medicines by the natives.

The Water Liverwort Family.

(Podostemaceæ).

Leafy branching plants like liverworts, not exceeding 6 inches in height, growing on stones, chiefly in running water; some consisting of erect stems, with numerous small flowers, having the appearance of a spike of *Plantago* with ripe seed, others being like glassworts. This singular family consists of nearly 100 species, divided into 21 genera, the greater number being natives of South America. In the region of the Rio Negro they form an important article of food to the natives for the greater part of the year, and New Grenada cattle feed upon them; several are found in India. Species of *Lacis*, when burnt, yield alkali.

The Water Starwort Family.

(Callitrichaceæ).

Annual or perennial floating plants, having opposite or whorled leaves, and inconspicuous achlamydeous flowers. They grow in all parts of the globe in deep or shallow water, and comprise two species, both found in this country. *Callitriche aquatica* abounds in ditches and canals, its leaves floating on the surface in the form of rays; hence its name Starwort. Hornwort (*Ceratophyllum demersum*), has long, slender floating stems, with whorled forked leaves. By some botanists these two plants are considered as types of distinct families, but by others they are placed in one.

Division 3.—Dichlamyds.

Flowers bisexual (generally), some unisexual furnished with calyx and corolla, which are seated below the ovary (*inferior*) or on its apex (*superior*). Corolla monopetalous or polypetalous, separate and free, or attached to the calyx. Stamens hypogynous or epigynous, or seated on the calyx or corolla, perigynous.

The corolla being monopetalous or polypetalous, and with the calyx seated above or below the ovary, admits of arranging the families of this division as follows.

Section 1.—Corolla monopetalous.

* *Calyx and corolla inferior.*
** *Calyx and corolla superior.*

Section 2.—Corolla polypetalous.

* *Calyx and corolla superior.*
** *Calyx inferior, with the corolla attached.*
*** *Calyx and corolla inferior, separate.*

The principal exceptions to the above characters are in the Begonia and Gourd Families being unisexual, as also in some monopetalous corollas being so deeply cleft as to appear

polypetalous, as in the Heath alliance. Also in the polypetalous section some are more or less monopetalous (or what is termed gamopetalous), the petals being united by their edges as in Gourds. The ovary is also subject to slight variation, being partially superior or inferior, as in the Saxifrage and Water Lily Families; in some the corolla is absent, but rarely so.

SECTION 1.—COROLLA MONOPETALOUS, INFERIOR (HYPOGYNOUS).

† Corolla generally oblique and bilabiate with didynamous perigynous stamens (Fig. 3, a) and 1 pistil.

This includes all plants characteristic of the fourteenth Class of Linnæus.

THE MINT, VERBENA, AND FOXGLOVE ALLIANCE.

The Mint Family.

(LABIATÆ).

Small shrubs, fruticuls, or herbs, generally with square stems, and opposite, simple, entire, rarely divided leaves; the whole generally aromatic. Flowers solitary, in spikes or heads. Corolla generally curved downwards, 2-lipped. Stamens didynamous (sometimes two abortive). Fruit consisting of 1 or 4 small 1-seeded nuts, contained within a persistent calyx.

This truly natural family consists of 2500 species. They are widely distributed, the greater part being found in the temperate regions of the northern hemisphere; they are also found, but sparingly, in the south. They contain a highly aromatic and pungent property, which has caused many of them to be held in high repute from time immemorial as possessing medicinal virtues, but few of them are now recognised in modern practice.

Lavender (*Lavandula vera*). A small shrubby plant, native of the South of Europe, bordering on the Mediterranean. It attains the height of 2 or 3 feet, having narrow leaves; it

is much cultivated in some parts of this country, especially at Mitcham, in Surrey, for the sake of its flower spikes, which are used as domestic scent. From these is obtained by distillation the oil of lavender, which, dissolved in spirits of wine, forms lavender water. *L. Spica* and *L. stœchas*, also natives of the South of Europe, yield an oil used by artists for varnishing, &c. Red lavender drops of the shops are made by a mixture of lavender and rosemary.

Rosemary (*Rosmarinus officinalis*). A stiff branching, bushy shrub 3 or more feet high, having narrow hoary leaves. It is a native of the South of Europe and Western Asia; like lavender, it is cultivated for its perfume, which is of a stimulating and refreshing nature, and has received the name of "Herb of Memory." It grows abundantly in some parts of France, especially in Narbonne, where it scents the air and imparts a flavour to honey. A conserve and liqueur are made from it, and it is also used in the manufacture of Hungary Water and Eau de Cologne. An oil is obtained from it which is used as a perfume. Rosemary was held in high esteem by the Greeks and Romans, its chief properties being a powerful stimulant to the nervous system, and was regarded as the emblem of fidelity.

Peppermint (*Mentha Piperita*). An herbaceous plant with creeping roots, native of this country. It is extensively cultivated for the volatile oil it contains, which is procured by distillation, and is used as a stimulant. Peppermint water is prepared from it. An oil having a scent like bergamot oil is obtained from *M. citrata.*

Spearmint (*Mentha viridis*). This has properties similar to the preceding, but in a less degree. It is used for culinary purposes, and is probably the "Mint"* spoken of in the New Testament.

Pennyroyal (*Mentha Pulegium*). The two preceding species are of upright growth, but this creeps on the ground. It has a strong, not disagreeable scent, and is an old favourite

* St. Matthew, chap. xxiii. ver. 23.

with country people as a remedy for throat diseases. This, with the two latter, also horse mint, (*M. sylvestris*) are natives of this country.

Sage (*Salvia officinalis*). A stiff shrub about 2 feet high, with rough hoary leaves, native of the South of Europe, and has been cultivated in this country for above two hundred and fifty years. It is well known as a culinary herb, and was at one time used as tea, having tonic qualities.

Marjoram (*Origanum vulgare*). A strong-growing perennial plant, native of this country, known by the name of wild marjoram. Oil of thyme is obtained from it, and is used by dentists and farriers.

Sweet Marjoram (*Origanum Majorana*), Pot Marjoram, (*O. Onites*), Winter Sweet Marjoram, (*O. heracleoticum*). Perennial plants, natives of the South of Europe, and known in this country as pot herbs.

Origanum Ægyptiacum is supposed by some writers to be the plant that formed the "bunch of hyssop,"* used by the children of Israel on leaving Egypt.

Sweet Basil (*Ocimum basilicum*). An annual plant, said to be a native of India, but it appears to have been early known in the South of Europe, and in this country for about three hundred years. It has a strong aromatic scent, being analogous to cloves, and is used for culinary purposes.

Garden Thyme (*Thymus vulgaris*). A small compact shrub, native of the South of Europe, and like the preceding has long been known in this country as an aromatic pot herb. In France an oil is extracted from it, known as oil of thyme, but for which marjoram oil is often substituted.

Hyssop (*Hyssopus officinalis*). A small shrub, native of the South of Europe, also long known in this country as an aromatic pot herb. This is not considered to be the hyssop mentioned in several parts of the Bible, and which probably relates to different plants. (*See* Index.)

Balm (*Melissa officinalis*). A perennial native of the

* Exodus, chap. xii. ver. 22.

South of Europe, and long cultivated as an aromatic herb. The favourite sweet-smelling window plant Balm of Gilead (*Dracocephalum canariense*), is a native of the Canary Islands, but is not the plant that produces the Balm of Gilead spoken of in the Bible.

Horehound (*Marrubium vulgare*). This is called white horehound; it is a strong growing plant with erect stems and hoary leaves, native of Britain, as also the South of Europe and Western Asia. It is a bitter herb, and its qualities medicinally are held in high repute as a remedy for coughs and colds.

Ground Ivy (*Glechoma hederacea*). A common creeping herbaceous plant with kidney-shaped leaves, native of this country; it has long been held in high repute for its medicinal virtues, which are however more imaginary than real.

Dittany of Crete (*Origanum Dictamnus* and *O. sipyleum*). Round hoary-leaved plants having hop-like flowers, often seen as window-plants.

Cat Thyme (*Teucrium marum* and *T. polium*). Small neat shrubs, not exceeding a foot in height, with small leaves, natives of the islands and coasts of the Mediterranean. The first is used medicinally, and excites sneezing. Cats are fond of rolling on it.

Summer Savory (*Satureia hortensis*). An annual. Winter Savory (*S. montana*). A small hardy evergreen shrub, 1 to 2 feet high, and, with the above, native of France and Italy. They are recorded as having been cultivated in this country as far back as 1562, and were then as now esteemed as pot herbs.

Patchouli-pat (*Pogostemon Patchouli*). An erect fruticul growing to the height of 2 or more feet, having broad oval leaves 3 or 4 inches in length. The dry leaves have a peculiar perfume, and are extensively used for many purposes; the scent of patchouli was considered as the test for the real Indian shawls; but since the introduction of the perfume into this country they cannot be depended on, home-made shawls being scented with it and sold as real Indian ones.

The leaves are also used as an ingredient in tobacco, and an essential oil is obtained from them and used as a toilet perfume. The Arabs in their pilgrimages take a great quantity of leaves with them, which are used in stuffing mattresses, pillows, and the like, and are supposed to keep off contagion.

Oswego Tea (*Monarda didyma*). A perennial, attaining the height of 1 or 2 feet, having whorled heads of fine scarlet flowers. It is a native of North America; the leaves have been used as a substitute for tea.

The Verbena Family.

(VERBENACEÆ.)

Large trees, shrubs, or herbs, generally with square stems. Leaves opposite, simple, or variously compound. Flowers small, inconspicuous, or of showy colours, produced in spikes, panicles, umbels, corymbs, or heads. Fruit a berry, or nut-like, 2 or 4 united.

A considerable family of plants, consisting of about 700 species, all widely distributed; the herbaceous species are generally found in temperate regions and in the tropics; in New Zealand it is represented by large timber trees. The properties of many of the smaller growing species are of the same nature as the mint family, and in their respective countries are held in much esteem for their medicinal virtues.

Vervain (*Verbena officinalis*). A weedy plant, native of this country, growing abundantly by roadsides and in waste places; in the time of the Druids it was held in high repute, and was worn as a charm against evil, and for good luck; but the advance of knowledge makes the history of Vervain, like many other things, only curious as legends. Verbenas have become favourite plants for ornamental flower-beds; a great number of varieties having come into notice of late years, which first originated from the scarlet-flowered species *V. melindres*, a native of South Brazil. The *Lemon-scented Verbena*, first known as *V. triphylla*, but now as

Aloysia citriodora, is a stiff branching shrub, with whorls of three leaves, native of Chili, and was introduced to this country about the end of the last century; it is hardy in many parts, and on account of its fragrance is often to be seen growing against cottages.

Teak Tree (*Tectona grandis*). A native of India, extending eastward to Burmah and islands of the Indian Ocean. It is a magnificent timber tree, the wood being hard and very durable; it is largely imported to this country, and used for shipbuilding and railway carriages. Its young branches are quadrangular with opposite ovate or elliptical leaves about 6 or 8 inches in length, and very rough on the upper surface, which renders them useful for polishing; they also yield a red dye, which is to be seen by the upper surface of the young leaves becoming of a red colour on being bruised. An oil called teak-wood oil is extracted, and used for varnishing and polishing wood, &c. The Indian teak forests are now under Government protection.

Another allied Indian tree is *Gmelina arborea;* it also has hard wood, which is used in India for many purposes, the same as teak, but it is a much smaller tree.

Vitex littoralis. A large tree, native of New Zealand, attaining the height of 50 or 60 feet, and of large diameter; it has digitate leaves, and very hard and heavy wood that is used for purposes under water. It is known by the native name *Puricri*.

The genus *Clerodendron* belongs to this family, a great number of showy species having been introduced. Most of them have large umbel-like heads of white or scarlet flowers.

In botanical alliance with *Verbenaceæ* and *Labiateæ*, is a small family named *Selaginaceæ*, consisting of 120 species of herbs, small shrubs, or fruticuls; those native of South Africa, are chiefly represented by the genus *Selago*, of which several species are cultivated in the greenhouses of this country; those of Europe and Madeira by the pretty blue-flowering genus *Globularia*. They

possess no particular qualities, except that *Globularia* is poisonous.

Stilbaceæ is a small family, by some botanists considered to be allied to *Verbenaceæ*. It consists of about half a dozen species of heath-like shrubs, natives of South Africa, having small flowers produced in terminal compact heads or spikes. They are only botanically interesting.

The Mustard Tree Family.

(SALVADORACEÆ.)

Soft-wooded trees or shrubs, with opposite, entire, leathery leaves. Flowers in compact panicles. Fruit a 1-celled, 1-seeded berry.

A small family, probably not exceeding 8 species, 5 of which belong to the genus *Salvadora*. They are natives of India, Ceylon, Arabia, North Africa, and Syria, the one most worthy of notice being *S. persica*, which is found growing in Palestine, in the valley of the Dead Sea, and on account of its Arabic name and pungent berries, it was supposed by Dr. Boyle to be the Mustard Tree* of Scripture, but this view is not generally received.

S. Indica, a native of Ceylon, is a much larger tree, having a diameter of 1½ to 2 feet, and of a very soft corky substance. Botanists differ in their views respecting the affinity of this family. It appears to have closer affinity to the present alliance than to any other.

The False Sandalwood Family.

(MYOPORACEÆ.)

Small trees, shrubs, fruticuls, or frutlets. Leaves alternate, simple, entire, rarely pubescent, sometimes with pellucid dots. Flowers solitary or several together in the axils of th

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* St. Matthew, chap. xiii. ver. 31.

leaves, or rarely in terminal heads. Corolla uniform, 4-lobed or bilabiate. Stamens nearly equal. Fruit a drupe-like nut 2- or 4-celled.

This family consists of about 40 species, chiefly natives of Australia, New Zealand, and the Pacific Islands; few are found in the tropics.

Bontia daphnoides. A small tree or shrub, native of many parts of the seashores in the West Indies, and on account of its resemblance to the olive, has long been known by the name of Barbadoes Wild Olive. It possesses no special qualities or uses.

Avicennia tomentosa. This is one of the trees called Mangrove; it occupies vast tracts of the seashores in tropical countries, and extends south to New Zealand and Tasmania. It is, like the true Mangrove, remarkable for extending its domains seawards by strong roots, which rise out of the mud in an arched entangled manner, again entering the mud and sending up asparagus-like shoots, forming extensive impenetrable coast jungles. In Brazil and other parts, the bark is used for tanning. It has opposite, entire, oblong leaves, 2 to 3 inches in length, having white down on the under surface, which has caused it to be called the White Mangrove.

Myoporum tenuifolium. A tree, native of the Sandwich Islands, attaining the height of 15 to 20 feet, and a circumference of 3 or 4 feet. The heart of the wood is fragrant, and having some appearance of Sandalwood, is called Spurious Sandalwood; it also contains an essential oil, but neither it nor the wood is esteemed like true Sandalwood. Several species of Australian *Myoporum*, as well as *M. lætum* of New Zealand, are cultivated in greenhouses as ornamental plants. *M. parvifolium* is a compact trailing plant, with numerous small pretty white flowers, and is very useful for planting in ornamental vases.

The Figwort Family.

(Scrophulariaceæ.)

Trees, shrubs, or fruticuls (some climbers), or herbs, often with square stems. Leaves simple, opposite, or whorled, or sometimes alternate. Flowers axillary, solitary or in spikes, racemes, or panicles. Corolla spreading or tubular, short or long, 4-lobed or curved and bilabiate, the lower lip in some inflated or spurred backward. Stamens 2 or 4, in some 5, perfect, as in *Verbascum*, or 1 sterile, as in *Pentstemon.* Pistil bifid, the lobes often broad. Fruit a 2-celled, 2- or 4-valved capsule, sometimes opening by pores, as in "Snapdragon," (fig. 8,) rarely a berry, seeds numerous.

Nearly 2000 species constitute this family, all being widely distributed, extending to the extreme limits of plant life in both hemispheres. They abound in the northern temperate regions, where they consist chiefly of herbaceous plants of a weedy nature, in the tropics and southern hemisphere they are generally shrubby. The whole of the family possess a more or less disagreeable odour, being mostly acrid and bitter, some even poisonous in a high degree. Few possess any properties useful in the arts or domestic economy, but many are highly ornamental plants when under cultivation.

Foxglove (*Digitalis purpurea*). One of our most showy native plants, generally found growing on margins and open parts of woods, and conspicuous by its tall spike of pink flowers; there is also a variety with white flowers. From its leaves is obtained a most important medicine, but it requires much caution in its use, for if unduly administered it suspends the action of the heart, causing sudden death.

The following are interesting as garden plants.

Paulownia imperialis. A moderate sized tree, native of Japan, introduced to this country about twenty years ago. It attains the height of 20 feet, or more, and has broad cordate leaves, producing its flowers in terminal loose spikes. Although hardy, the season of flowering is too early to admit

b
a
c
d
e

of their being perfectly developed in all localities. Its winged seeds are beautiful microscopic objects.

Halleria lucida. A handsome greenhouse shrub, native of the Cape of Good Hope.

Brunfelsia (or *Franciscea*) *Americana*, *B. latifolia*, *B. calycina*, *B. uniflora*, are handsome hothouse shrubs, and with the two preceding genera may be considered the most tree-like or woody plants of the family. New Zealand furnishes the beautiful *Veronica salicifolia*, *V. formosa*, and others.

Monkey-flower (*Mimulus luteus*). A native of North America, but has now become naturalized in some parts of this country. Many varieties have been raised, which with the Musk plant (*M. moschatus*), native of North West America, have become favourites in gardens. In this genus the stigma is bilabiate and irritable, the two lips collapsing together when touched with a sharp point.

The genus *Calceolaria*, of which there are numerous species, natives of Chili and other parts of South America, have many varieties raised from the original introduced species, and now prized as flower-garden plants.

Snapdragon (*Antirrhinum majus*). A native of this country, the varieties of which and several species of *Linaria*, *Pentstemon*, *Veronica*, *Chelone*, and many others, are well known hardy garden plants.

In the greenhouse *Lophospermum erubescens*, *Rhodochiton volubile*, natives of Mexico, and *Eccremocarpus scaber*, are ornamental climbers.

The family is represented in this country by about 40 species.

On account of the genus *Verbascum* having 5 stamens, it has been placed by some botanists in Solanaceæ, while others place it in the present family. They are tall growing biennial or perennial plants, mostly having woolly stems and leaves, 6 species being natives of this country.

Great Mullein (*Verbascum Thapsus*) has long been famed as a domestic medicine, and in consequence of its being used in pulmonary complaints in cattle, it has received the name of "Bullock's Lungwort." The dry stalks and leaves were in

ancient times dipped in grease, and used as a substitute for candles and lamp-wicks. In this country it is called High or Hag taper, on account of the superstition that it was used by witches of old. In Scotland it is known by the name of Shepherd's club.

The Butter, or Bladderwort Family.

(LENTIBULARIACEÆ.)

Rosette-leaved herbs or entangled branching floating plants, the leaves of the latter generally divided and root-like, bearing small air bladders (rarely peltate). Flowers in the former rising from the centre, and in the latter in panicles rising above the water. Calyx persistent. Corolla irregular, 2-lipped, the base generally with a spur, or nectary cyst. Stamens 2. Fruit a 1-celled capsule with many seeds.

This family consists of 100 or more species. They are found in temperate regions, but most abundantly in the tropics, and are chiefly represented by the floating genus *Utricularia*, of which there are two species natives of this country, *U. vulgaris* and *U. minor*, known by the name of Bladderworts. They have pretty yellow flowers. Another interesting native species is the "Butterwort," a small rosette-leaved plant with pretty purple flowers, growing in moist places. It possesses the curious property of coagulating milk when poured over the leaves.

Utricularia nelumbæfolia. A native of Brazil. A plant with round peltate leaves resembling pennywort. Although a water plant, its habitation is on trees, being found only in the water contained in *Tillandsia;* the *Utricularia*, dipping its running stem into one where it fixes itself, passes on to the next, thus connecting the Tillandsias together.

The Broomrape Family.

(OROBANCHACEÆ.)

Parasitical herbs growing on the roots of furze, broom, clover, flax, &c. They consist of a simple leafless, fleshy

stem, from 6 inches to 2 feet or more in length, of a pale brown, red, or even blue colour, furnished with bract-like scales, terminating with a spike of labiate flowers; rarely one-flowered, of the same colour as the stem, and differing little in character from the preceding family. Above 100 species are described, but on account of their different appearances, caused by the plants on which they grow, probably not more than one-half that number are distinct. They are widely distributed in Western Asia and North America, are also found in South Africa, and a few in India. Seven are natives of this country, of which *Orobanche major* is the largest species, growing on the roots of broom and furze, attaining the height of 2 feet. *O. minor* grows on clover and flax, sometimes to the injury of the crops. *O. ramosa* differs from the rest in being branched; it is widely dispersed, being found at the Cape of Good Hope, in Abyssinia, Europe, and Siberia. They possess astringent qualities, and have some medicinal reputation.

Toothwort (*Lathræa Squamaria*). A native of this country, growing abundantly in open parts of woods. It has pale-coloured stems, almost white, about 6 inches in height. On account of the shape of the flower being like teeth, it was in ancient times supposed to be a cure for toothache, but such was mere fancy. In their general habit and manner of growth they resemble the Cistus-rape family, but their complete flowers distinguish them from it.

The Acanthus Family.

(ACANTHACLÆ.)

Shrubs, fruticuls, some climbers or perennial gemmæcorm herbs; some spiny, generally with square stems having swellings below the leaves, which are opposite, simple, entire, or variously lobed, or deeply slashed and spiny. Flowers axillary, or more generally in terminal spikes, racemes, or panicles, sometimes pendulous, often furnished with leafy bracts. Fruit a 2-celled, 2-valved, round or compressed capsule, bursting with elastic force.

This extensive family consists of about 1500 species, natives chiefly of the tropics. They are generally of a weedy nature, and of no special use to man; many are, however, used in medicine in their respective countries. Some have handsome flowers, such as *Justicia*, *Cyrtanthera*, *Thunbergia*, *Aphelandra*, *Ruellia*, *Meyenia*, *Hexacentris*, &c., and on that account are cultivated in the hothouses of this country. In Europe it is represented by *Acanthus spinosus* and *A. mollis*, hardy perennials, the leaf of which is the adopted pattern for the architecture of the Corinthian capital. *Ruellia tinctoria*, a native of Assam and other parts of India, where it is called "Room," is probably the same as *R. indigotica*, a native of China. They afford a blue dye equal to indigo, which is obtained by maceration of the stalks and leaves in water, and is extensively used in India and China for dyeing all manner of cloth.

The Gloxinia Family.

(GESNERACEÆ.)

Erect or trailing fruticuls, frutlets, or herbs, often with tuberous or scaly root-like stems (lepicorms). Leaves simple, opposite, or whorled. Flowers solitary, or in racemes, or panicles. Corolla spreading or tubular, showy. Fruit capsular, or berry-like with many seeds.

This family, which probably consists of nearly 300 species, is widely distributed, being found chiefly in the tropics; but some beyond, as *Streptocarpus* in South Africa, *Fieldia* in New South Wales, and *Ramondia pyrenaica* in Europe. Tropical America abounds in species of *Gesneria*, *Gloxinia*, and *Achimenes*, while in the East they are represented by *Æschynanthus*, *Didymocarpus*, *Chirita*, and many others well known as beautiful flowers in our greenhouses, for which only the family is worthy of special notice, as they possess no useful qualities.

The Sesamum and Grapple Plant Family.

(Pedaliaceæ.)

Annual plants with simple, alternate, opposite leaves, furnished with soft glandular hairs, rarely spiny. Flowers generally large and showy, similar in character to *Bignoniaceæ*, the principal difference being in the fruit, which at first is soft, becoming a 1-seeded, hard, spiny, capsular fruit, generally splitting, with 2 or more hooked appendages.

About 25 species are enumerated of this family. They are natives chiefly of the tropics, where they are widely distributed, the greater number being found in Africa. They are of a mucilaginous nature, the most important being *Sesamum Indicum*, an annual plant, native of the East Indies, and now cultivated in many warm countries for the sake of its seeds, which yield "Gingilic oil," used for many purposes of domestic economy, and even for adulterating olive oil. In gardens the family is represented by *Martynia fragrans*, and other species, having showy flowers like foxglove. Allied to them is the Grapple plant (*Uncaria procumbens*), native of the Cape of Good Hope.

They are remarkable for their curious fruits, which in *Martynia* when dry become hard and black, having two stiff incurved hooks at one end from 1 to 2 inches or more in length, formed by the splitting of the placenta, having some resemblance to a stag beetle. In *Uncaria* the fruits are more like a large spider with eight long legs terminated with incurved hooks. The size of an average fruit is about 3 inches each way. These hooks are extremely troublesome to travellers, hooking into their clothes, and are a torture to cattle by hooking into their mouths.

Pedalium murex. An annual, soft, succulent-leaved plant, native of the coasts of the Western Peninsula of India and Ceylon. It has a musky smell, and possesses the peculiar property of imparting mucilage to water simply by the

leaves being drawn several times through it, which renders it milky; it is used for adulterating milk.

THE TRUMPET FLOWER AND CALABASH ALLIANCE.

The Calabash Family.

(Crescentiaceæ.)

Small trees or climbing epiphytal shrubs, with simple, winged, serrate, or digitate, alternate leaves. Flowers produced on short footstalks, two or more together on the old stems or branches. Corolla regular or slightly curved, and 2-lipped. Stamens didynamous, with a rudiment of a fifth. Fruit large, woody, globose, or more or less elongated and cylindrical (club gourd-like), containing numerous kernel-like seeds embedded in pulp.

About 40 species constitute this family. They are widely distributed throughout the tropics, but the greater number are found in Madagascar and Mauritius.

Calabash (*Crescentia cujete*). A well-known tree, wild and cultivated throughout the West Indies and tropical America. It is a rude branching tree, attaining the height of 20 to 30 feet, with simple leaves, or often three together on a broad leafstalk. This and *C. cucurbitina* are most important for the purposes to which the shells of their fruit are applied; the first has globose fruit varying in size from a few to 18 inches in diameter; that of the latter being more oval and oblong, and also of various sizes. Domestic utensils, such as cups, water-bottles, spoons, and the like, are made from them, which are in as common use in their respective countries as crockery-ware is in this country. The pulp in which the seed lies is used by negroes as a medicine.

Kigelia pinnata. A tree, native of Eastern Africa, extending from Egypt to Natal. It has winged leaves and somewhat spindle-shaped gourd-like fruit, from 18 inches to 2 feet in length, and from 5 to 8 inches in girth. It has no remarkable

qualities, but is held sacred by the negroes in the performance of their religious ceremonies.

Parmentiera cereifera. A tree attaining the height of 20 feet, native of the forests of Panama; it has trifoliate leaves, and fruit from 3 to 4 feet in length, and about 1 inch in diameter, of a yellowish colour, hanging from the tree so as to present the appearance of wax-candles, and in such abundance as to give the idea of a chandler's shop, whence it has received the name of Candle Tree. They are greatly used as food for cattle, which fatten on them, but imparts an apple-like smell to the flesh.

The Trumpet-Flower Family.

(BIGNONIACEÆ.)

Trees or shrubs, often climbing, rarely frutlets, having stems or young branches more or less compressed or angular. Leaves opposite, simple or compound, often furnished, in the American species, with claw-like tendrils. Flowers solitary, or in terminal racemes or panicles. Calyx entire, 2-lipped or spathe-like. Corolla tubular or bell-shaped, nearly regular or curved, and somewhat 2-lipped. Stamens generally 5, unequal in length, sometimes 3 sterile. Fruit a pod-like 2-valved capsule, round, oblong or long, flat or cylindrical, containing numerous flat seeds, generally surrounded by a membranous wing.

Nearly 500 species constitute this family, many of which are large trees, others climbers, entangling tropical forests, their stems often looking like ropes and cables, and adding great beauty to the scenery by brilliant clusters of trumpet-shaped flowers. They are represented throughout tropical and temperate America, Asia, Australia, and South Africa. With the exception of a few held in repute in their respective countries for medicinal virtues, they possess but few economic uses. *Bignonia Chica*, a creeper, is however of importance, its leaves, when soaked in water, depositing a red

pigment, with which the Indians in the countries of the Orinoco paint their bodies.

Catalpa syringæfolia. A native of the United States, introduced to this country about one hundred years ago; it is a hardy spreading branched tree, attaining the height of from 20 to 25 feet, having heart-shaped leaves and handsome erect racemes of white flowers.

Bignonia radicans. A climbing plant with pinnate leaves, and large bunches of trumpet-shaped orange-coloured flowers. It is a native of North America, and grows freely in this country, clinging to walls by its stem-roots like ivy.

Allied to this but not so hardy, and having larger flowers, is *B. grandiflora*, a native of China. *B. capreolata*, of North America, is also a creeper, supporting itself by tendrils, but not so showy as *B. radicans*. *B. capensis*, introduced in 1821 from the Cape of Good Hope, *B. Jasminoides*, of Australia, with several Brazilian species, are showy creepers. *B. adenophylla*, *B. amœna*, are trees, natives of India, having very showy flowers.

Spathodea campanulata. A tree native of the West and other parts of tropical Africa, has pinnate leaves and large campanulate flowers like the orange lily.

The Horseradish Tree Family.

(Moringaceæ.)

Small trees, with twice or thrice winged leaves, and coloured deciduous stipules. Flowers white, in panicles. Petals 5, unequal, their base united in the tube of the calyx. Stamens 10, part abortive and 4 didynamous. Fruit a long 3-sided, 3-valved pod, containing 1 row of pea-like seeds.

The four known species of this family are natives of the East Indies and Arabia, but they have been introduced to many other tropical countries. The only species of importance is

Moringa pterygosperma. A small tree. On account of its bark and roots having the flavour of horseradish, and being used as such, it is known in the English colonies by the name

of Horse-radish Tree. Its seeds by pressure yield an oil, which is extensively used in India and other countries for many purposes. It is known by the name of Ben oil, and is used by watchmakers. The unripe pods make an excellent vegetable. On account of the peculiar structure of the flower and fruit of this family, botanists have differed in their views with regard to its relationship. In some points it is related to the Pea Family, but it has been lately referred to this alliance.

** *Corolla straight, regular, tubular, urceolate or spreading,* 4 *or* 5 *toothed* (*Fig.* 2, *a.*) *or cleft, nearly polypetalous. Stamens* 5, *perigynous. Pistil* 1 *or rarely* 2.

THE CONVOLVULUS, DOGBANE, AND SWALLOW-WORT ALLIANCE.

The Dogbane Family.

(Apocynaceæ.)

Trees, shrubs, or herbs, often climbing and twining, containing milky juice. Leaves opposite sometimes whorled or irregular, entire. Flowers variously produced, often large and showy. Calyx persistent. Corolla convolute, with corona-like appendages. Stamens 5. Pistil 1, or generally 2, to which the anthers closely adhere. Fruit fleshy with embedded seeds, or a double follicle or capsule, containing numerous winged seeds.

This extensive family consists of nearly 600 species, chiefly tropical, being represented in Europe by *Vinca*, in North America by *Apocynum*, and in Australia by *Alyxia*, *Lyonsia* and others. With a few exceptions their principles are of a highly poisonous nature, but some are harmless and yield useful products.

Oleander (*Nerium Oleander*). A handsome evergreen shrub, native of the Levant and naturalized in the South of Europe; it has been cultivated in this country for three hundred years,

and with the myrtle and orange was one of our first greenhouse plants. It is highly ornamental, and has very fragrant flowers. It grows abundantly in the valley of the Jordan, and when in flower is very beautiful. The whole of the plant is poisonous, and it is recorded that soldiers in Spain were poisoned through their meat being roasted on spits made of the peeled stem. *Nerium*, or, as now called, *Adenium obesium*, is a remarkable gouty stemmed almost leafless plant, growing on dry rocks at Aden. Small plants about 2 feet high were received at Kew which had a resemblance to Champagne bottles.

Adenium Namaquanum. A native of Namaqualand in South Africa. It is a singular plant having an erect stem about 6 inches in diameter, slightly tapering up to the height of 5 or 6 feet, bearing on its apex a tuft of obovate leaves 4 to 5 inches in length, and a few bunches of small purple flowers. The stem is covered with tubercles, each tubercle furnished with two spreading horny spines.

Ordeal Tree of Madagascar (*Tanghinia venenifera*). A soft-wooded tree, with stiff branches and elliptical lanceolate leaves, 4 or 5 inches in length, generally in tufts at the apex of the branches, and leaving a prominent mark or scar on falling away. It has pretty whitish-pink flowers, and produces a fleshy fibrous drupe, about the size of a magnum bonum plum, containing a hard stone seed, the kernel of which is highly poisonous. In Madagascar, persons suspected of crime are made to swallow a small portion of the kernel, and if they die from its effects, are supposed to be guilty. It is said to produce death in twenty minutes. Condemned criminals are also put to death by simply being pricked with a lance dipped in the juice of the kernel.

Wheel-tree or Paddle-wood (*Aspidosperma excelsum*). A large tree, native of Guiana, and is remarkable in having the stem regularly fluted, often giving the appearance of several small trees stuck to a large one, which are cut away and used by the natives as paddles. It is sometimes 4 or 5 feet in diameter, and when cut transversely the section has the

appearance of the rays of a wheel, and when cut longitudinally form ready-made planks.

A number of Brazilian trees of this family yield an abundance of milky juice, and are called Cow Trees. Two species of *Collophora* found on the Rio Negro are handsome trees, from 30 to 35 feet high, having beautiful bunches of red flowers. On the stems being pierced the juice flows abundantly, and is used by the Indians for milk.

Roupellia grata. A handsome creeper, native of Sierra Leone, and has been introduced to this country. It has pretty white flowers tinted with pink. This was once supposed to be the Cream-fruit tree, but it has been lately proved not to be correct, the tree producing such being still unknown.

Carpodinus dulcis and *C. acidus.* Climbing plants, also natives of Sierra Leone. The first has fruit of a yellowish colour, about the size of a lemon, and the latter somewhat smaller. They are pulpy, and when cut yield a quantity of sweet milky juice, which is found agreeable. The first is known by the name of Sweet, and the latter Sour Pishamin.

Urceola elastica. A large climber, having a black stem as thick as a man's body. It is a native of Borneo, and other contiguous islands. A quantity of caoutchouc is obtained from it. The fruit is the colour of an apricot, and is wholesome.

Vahea madagascarensis and *V. gummifera.* Natives of Madagascar, are also large climbers, almost becoming trees, yielding abundance of caoutchouc. There is another species, native of Western tropical Africa, which is believed to be one of the plants that supplies the caoutchouc of that country.

Carissa Carandas. A large straggling spiny shrub, with small leaves and flowers, growing abundantly on the coast of Coromandel. Its fruit, which is the size of a small plum, is pickled and made into preserves.

Arduina bispinosa. A compact, stiff, spiny bush, with

box-like leaves and small sweet-scented white flowers. It is a native of South Africa, and produces an oblong drupe-like fruit, of which there is a large variety. *A. grandiflora* is called Natal Plum. They make excellent preserves.

Alstonia scholaris. A large tree, native of Ceylon, India, and Burmah. The leaves grow in whorls round the branches. It yields a milky juice, which is used as gutta-percha. The wood is light and white, and is used for domestic purposes.

The family is represented in the open air in this country by four species of *Apocynum*, three being natives of North America. They are perennial plants, extending to a great distance by their running roots, and have small pink flowers. They have tough fibre, that of *A. cannabinum* and *A. hypericifolium* is made by the Indians into fishing nets, lines, &c.; and is known by the name of Indian Hemp. A considerable number are cultivated in hot-houses as highly ornamental plants—such as *Allamanda*, *Echites*, *Dipladenia*, and *Plumieria*. *P. rubra*, in the West Indies being called Red Jasmine, as also "Frangipane"—a name also given to the sweet-smelling flowers of *P. acuminata*.

Tabernæmontana coronaria. A native of India, the variety with double flowers forms a good substitute for the Cape Jasmine. As a curiosity, it may be mentioned that the Cingalese have a tradition that the Garden of Eden was situated in Ceylon, and that a species of this genus was the "tree of knowledge of good and evil."

The Swallow-Wort Family.

(ASCLEPIADACEÆ.)

Gemmæcorm herbs, or erect, or generally twining or climbing epiphytal fruticuls, or with fleshy (sarcocauls) or tubercorm stems, the whole containing milky or watery juice. Leaves entire, opposite, whorled or alternate, often with a ringed footstalk. Flowers solitary or few together, or in umbels or racemes. Calyx persistent. Corolla 5-lobed, with

a central more or less elevated 5-sided corona, bearing 5 stamens, each consisting of two separate masses of pollen attached to a gland. Stigmas 2, generally covered with the corona, which has 5 vertical slits or pores in its sides, through which the pollen reaches the stigmas (fig. 4, *c* and *d*). Fruit generally in two distinct follicles, compactly packed with seeds, furnished with fine silky hairs.

Nearly 1000 species constitute this family. They are of remarkable diversity of form, and generally abound within or near the Tropics; a great number being natives of dry arid places in South Africa, chiefly consisting of the succulent and leafless genus *Stapelia*, the tuberous stemmed *Brachystelma* and such like plants. In India and the Malayan Islands they are represented by climbing *Hoyas*, *Ceropegias*, *Stephanotis*, &c.; in Tropical America by *Gonolobus;* and in north temperate regions by *Asclepias Cynanchum* and the climbing *Periploca* of the South of Europe.

The principle of the family is on the whole acrid and poisonous, but in some cases the milk is said to be harmless; many, however, have great reputation in their respective countries for their medical virtues, such as *Tylophora asthmatica*, the roots of which are substituted in India for Ipecacuanha.

Gymnema sylvestre. A tree, native of the northern part of India, having thick fleshy leaves, which, when chewed, have the singular effect of destroying the taste of sugar, making it feel like sand in the mouth. The most important products of the family are fibre and caoutchouc. Many are cultivated, and much admired in the hothouses of this country, such as *Stephanotis floribunda*, *Hoya carnosa*, *H. imperialis*, several species of *Ceropegia*, and numerous species of *Stapelia*, the flowers of the latter being fleshy and having the odour of putrid meat (see page 52).

Muddar (*Calatropis gigantea*). A shrub or small tree about 15 feet high, native of India, yielding a fibre equal to hemp, and a kind of gutta-percha is obtained from its milky juice. *C. procera* is abundant in the valley of the Dead Sea,

and its fruit is by some supposed to be the "Apple of Sodom." The roots of *Hemidesmus indicus*, are much used in India as a substitute for Sarsaparilla, and are called "Indian Sarsaparilla."

The Bindweed Family.

(CONVOLVULACEÆ.)

Shrubs, fruticuls, or herbs, often tubercorms, erect, twining or creeping. Leaves alternate, entire, or lobed. Flowers axillary or terminal, generally on long footstalks, 2 or more together, or in a one-sided raceme, some with bracts, which enlarge after flowering. Calyx imbricated, often unequal. Corolla tubular or salver-shaped, twisted before expansion. Fruit a capsule, dry or succulent.

Nearly 700 species constitute this family. They are chiefly found in warm countries, the great mass being represented by twining plants, many of which have beautiful flowers, but of short duration, opening only at night and fading early in the morning. The greater number abound in a milky juice which is of an acrid principle.

Originally the largest mass of the species of this family were contained in the genus *Convolvulus* and *Ipomea*, but modern botanists have separated them into a number of smaller genera.

Sweet Potato or Batata (*Batatas edulis*). This is supposed to be originally a native of India, but it has long been universally cultivated throughout all tropical and subtropical regions. It forms one of the principal articles of food for the natives of New Zealand and Islands of the Pacific. It is a twining plant with heart-shaped leaves, having flowers like convolvulus, and tuberous roots like potatoes; by change of letters and pronunciation, the name potato was derived from the Spanish Batata. There are many varieties, varying considerably in size and shape from that of an ordinary potato to several lbs. in weight, some in Java attaining a large size. They are imported to this country from Spain.

Batatas Jalapa. A native of Mexico, near Xalapa, from whence it takes its name. It has large farinaceous roots, which are of a purgative nature, but although called Jalap, it is not the plant which yields the true drug of that name, which is produced by *Exogonium Purga*, a native of the higher regions of Mexico. The roots are round, of various sizes, and contain a resinous secretion, which is the strong purgative Jalap used in medicine.

Ipomæa tuberosa. A native of Jamaica, and often grown in greenhouses in this country; it also has purgative qualities.

Scammony (*Convolvulus Scammonia*). A long thick tuberous-rooted herbaceous plant, native of Western Asia. Scammony is obtained by cutting off the top of the root at the surface of the ground, when a milky juice exudes which, after becoming hard, is collected. It comes to this country from Aleppo and is used as a purgative medicine. An inferior kind, believed to be the produce of *Periploca Scammonium*, comes from Smyrna.

Oil of Rhodium (*Convolvulus Scoparius* and *C. floridus*). Two small erect, branching shrubby species with small silky leaves and white-and-pink flowers, natives of the Canary Islands. On account of the scent their wood is called "rose-wood," from which an oil is extracted which is used in adulterating attar of roses. The wood is now very rare.

Convolvulus dissectus. A tropical species cultivated in France. It abounds in prussic acid, and is used in making the liqueur called noyeau.

Many of the species of this family form very ornamental creepers in hothouses, but to have them in perfection they require much space. A number of years ago a plant at Kew of *Ipomæa mutabilis* covered a space of 150 square feet, and during the flowering season 200 of its beautiful blue flowers have been counted open at the same time.

Ipomæa bona-nox. An annual, native of the East Indies. It has large flowers 5 to 6 inches in diameter, which being pure white have a remarkable appearance at night, and has led to the name of "moon flower" being applied to it.

Similar to this, but not in size, is the common Bindweed (*Convolvulus*), (*Calystegias epium*). *C. tricolor*, native of the shores of the Mediterranean, as well as others, ornament the flower garden in summer.

The Dodder Family.

(Cuscutaceæ.)

Parasites destitute of leaves, twining round other plants like coils of thread or string. Flowers in small sessile compact clusters. Fruit a capsule or berry.

As a family this is by some botanists not considered distinct from *Convolvulaceæ*. It consists of about fifty species, chiefly natives of temperate countries, the whole generally considered to belong to the genus *Cuscuta*, of which there are two species natives of Britain, viz., *C. Epithymum*, which grows abundantly on heath, and *C. europæa* upon thistles and nettles or other soft plants within its reach, involving the whole in destruction. Of late years two other species have accidentally been introduced, viz.,—Flax Dodder (*C. trifolii*) and Clover Dodder (*C. Epilinum*). The first destroys whole fields of flax and the latter preys to a great extent on clover, both plants being the cause of great losses to the agriculturist. In India some species are very large and powerful, involving trees of considerable size in their grasp. The seeds of Dodders vegetate in the ground, but when the young plant is of sufficient length to attach itself to a contiguous plant of another family, it ceases to have further connexion with the ground but derives nourishment from the plant it has become attached to.

THE PRIMROSE AND PHLOX ALLIANCE.

The Primrose Family.

(Primulaceæ.)

Herbs, tubercorms, or frutlets with erect or trailing stems, or with radical leaves rising from a centre in rosette form,

rarely aquatics. Leaves simple, rarely pectinate, opposite, whorled, or alternate. Flowers solitary in spikes, loose umbels, or axillary. Calyx and corolla tubular, spreading or reflexed. Fruit a dry capsule, opening by valves, or by a horizontal circular separation (as in *Anagallis*).

This interesting family is represented by above 200 species, chiefly natives of the northern hemisphere, extending to high latitudes and Alpine regions, even to the verge of perpetual snow, also in elevated situations within the tropics. Many species of *Soldanella*, *Cyclamen*, *Primula*, and *Androsace*, are interesting and beautiful plants in the flora of the Swiss Alps, and are much esteemed in Alpine collections in this country, *P. Auricula* having been introduced nearly three hundred years ago, and by cultivation has produced many fine varieties that are highly prized by florists. Several species, natives of this country, are also interesting, such as, Primrose (*Primula acaulis*), Cowslip (*P. veris*), Ox-lip or Polyanthus (*P. elatior*), Loose-strife (*Lysimachia vulgaris*), Money-wort (*L. nummularia*).

The American Cowslip (*Dodecatheon media*) is also a beautiful hardy perennial plant. The Chinese Primrose (*Primula sinensis*) is now extensively grown as an early spring flowering plant well suited for room decoration. The genus *Anagallis* has beautiful red and blue flowers; the red pimpernel or four o'clock plant (*A. arvensis*), is common in waste places and cornfields. The most anomalous of the family is probably the Water Violet (*Hottonia palustris*), a pretty perennial plant growing in shallow pools and ditches in many parts of this country, having its finely pectinate floating leaves in a rosette form, from the centre of which rises a spike of pale blue or white flowers. The properties of the family are of an acrid nature, but not of much medicinal importance.

The Phlox Family.

(Polemoniaceæ.)

Herbs, perennial or annual; rarely climbing or shrubby; having alternate, winged or more compound leaves. Flowers solitary, spiked, in panicles or corymbs. Corolla generally 5-lobed. Fruit a 3-valved capsule, with numerous seeds.

This family consists of above 100 species, chiefly natives of temperate countries in the northern hemisphere, and South America. They possess no particular qualities, but many have been long cultivated in gardens for their showy flowers, such as different species of *Phlox*, *Gilia*, *Polemonium*, *Limnanthes*, *Leptosiphon* and others, while several species of the genus *Cantua*, shrubs, with beautiful pendulous, tubular flowers are ornamental greenhouse plants, not the least in importance being the well known *Cobæa scandens*, but which must, however, be considered anomalous in the family, as its general appearance is more characteristic with the Bignonia family. The seeds of *Collomia grandiflora* are beautiful objects in the microscope; on being moistened, a mucous cloud is seen around them, which ultimately separates into a number of spiral threads.

The Leadwort Family.

(Plumbaginaceæ.)

Herbs, or tufty evergreen frutlets. Leaves alternate, simple, broad, or narrow and grass-like, sometimes in tufts, some covered with chalk-like scurf. Flowers in heads or spikes, or simple or much branched panicles, blue, pink, rarely white or yellow. Calyx plaited, sometimes coloured. Corolla a narrow angular tube, or of 5 petals. Fruit membranous, bladder like, 1-seeded.

Nearly 250 species constitute this family, the greater portion being natives of north temperate regions, a few extending to high latitudes in the south. Some are powerfully

astringent, and the greater portion are acrid and blistering, as in *Plumbago europea*, which is used by beggars for raising artificial sores. Many species of the genus *Statice*, natives of the Cape of Good Hope and Canary Islands are well known as ornamental greenhouse plants. "Sea Thrift" *Statice Armeria* is common on the sea shores in this country, and is frequently used for border edging in gardens. *Plumbago carpentæ* is an ornamental hardy perennial, native of China. *P. rosea* and *P. zeylanica* are pretty flowering stove plants.

The Rib Grass Family.

(PLANTAGINACEÆ.)

Annual or perennial herbs or frutlets, having generally broad or narrow leaves rising from a centre in a rosette form, and usually ribbed from the base to the apex. Flowers in simple compact spikes. Calyx 4-parted. Corolla thin, 4-lobed, persistent. Stamens 4. Fruit a membranous capsule, opening transversely (fig. 8), containing 1 or many seeds.

About 100 species are contained in this family, consisting chiefly of species of the genus *Plantago*. They are generally weedy plants, widely distributed, principally in temperate regions, and represented in this country by Rib Grass (*P. lanceolata* and *P. major*), the seed spikes of the latter being in common use for feeding cage birds. *P. media* is common in pastures and hayfields. Its retention of moisture leads to great delay in the drying of hay, and its fermentation often causes haystacks to take fire, on which account it is called by the farmers fire leaves.

P. coronopus is common in waste places; it has divided leaves, and in some localities has received the names of Bucks Horn Plantain, or Star of the Earth. The leaves are used in France as a salad. The seeds contain much mucilage; those of *P. arenaria* are imported from the South of France, and used in the manufacture of muslin.

THE BORAGE AND NIGHTSHADE ALLIANCE.

The Borage Family.

(Boraginaceæ.)

Shrubs or herbs. Leaves simple, alternate, covered with hairs, which often rise from tubercles, and give a degree of roughness specially characteristic of the family. Flowers sometimes solitary and axillary, but generally in twisted one-sided spikes or racemes. Corolla tubular or salver-shaped. Fruit 4 distinct nuts, or 2 and 2 united, each 1-seeded, included within the permanent calyx.

This family consists of nearly 700 species, almost all confined to the temperate countries of the northern hemisphere, the greater number being natives of Europe and Western middle Asia. Comparatively few are found in North America. In the Canaries, Madeira and countries of the Mediterranean they are represented by shrubby and showy species of *Echium*. They are soft, mucilaginous and innocuous. A great number are of a weedy nature.

Borage (*Borago officinalis*). A native of England, growing in neglected places. It attains the height of 2 or 3 feet, having very rough leaves and pretty blue flowers. It is grown in gardens, and used for making a cooling drink, called cold tankard. Its famed virtues for other purposes are however much more ideal than real.

Comfrey (*Symphytum officinale*). A strong growing perennial plant, native of Britain, which has long had its virtues extolled, but, like those of Borage, they are imaginary. The young sprouts are sometimes blanched and used as Asparagus.

Alkanet (*Anchusa tinctoria*). A strong growing perennial plant with pretty blue flowers, native of the South of Europe, and cultivated in many parts for its roots, which are imported from France and Germany. They yield a red dye, which is used for colouring oils, wax, salve, &c.

Vipers Bugloss (*Echium vulgare*). A native of this country, generally growing on rocky cliffs near the sea. It is very showy, having spikes of purple red flowers. *E. fastuosum*, *E. giganteum*, and *E. candicans*, strong growing shrubby species, natives of Madeira and the Canaries, with *E. fruticosum* and others, natives of the Cape of Good Hope, have been long cultivated in greenhouses. The well known Forget-me-not (*Myosotis palustris*) belongs to this family.

In alliance with *Boraginaceæ* is *Hydrophyllaceæ*, consisting of nearly 100 species, chiefly natives of temperate and tropical America. The principal part are herbaceous plants, and are represented in gardens by the genera *Hydrophyllum*, *Phacelia*, *Eutoca*, and the pretty annual *Nemophila insignis*. Several are shrubby, and even spiny, as *Hydrolea zeylanica*, a pretty blue-flowered shrub. *Wigandia caraccasana*, a large-leaved strong-growing plant, native of Caraccas, attaining the height of 3 or 4 feet, has lately become an ornamental garden plant.

The Nightshade Family.

(SOLANACEÆ.)

Small trees, erect or trailing shrubs, frutlets, or perennial or annual shrubs. Leaves soft, alternate, simple, entire, or lobed, some winged. Flowers axillary, solitary, or in terminal cymes or racemes. Corolla tubular or spreading. Fruit a 2-valved or many-celled capsule, or a pulpy berry often included within a persistent calyx.

This extensive family consists of above 900 species, distributed throughout all climates of both hemispheres, *Solanum nigrum* presenting itself near the arctic circle, as well as in high southern latitudes. The greater number are tropical, of which about one half belong to the genus *Solanum*. Although some in a prepared state are useful and wholesome, the whole family is more or less poisonous, many in the highest degree, as the Deadly nightshade.

Potato (*Solanum tuberosum*). This well-known esculent is

a native of Peru and Chili, and has also been found wild in Mexico. It was first introduced into Spain about the beginning of the sixteenth century, and into England from Virginia by Sir Walter Raleigh, in 1586. Gerarde, in his Herbal, published in 1597, gives a figure of a potato plant, which he had growing in his garden in Holborn (London), under the name of *Batata virginiana*.

The cultivation of the potato spread very slowly. About 1633 it was encouraged by the Royal Society; but it was not until nearly a century had elapsed that it became plentiful, and was successfully cultivated in Scotland. It is singular that in "The Complete Gardener," published by London and Wise in 1719, the potato is not mentioned: and about the same time Bradley, an extensive writer on horticultural subjects, speaks of it as being inferior to skirrets and radishes.

During the last hundred years, the cultivation of the potato has greatly increased in importance, especially in poor and densely populated districts. The ravages of a disease,* which first appeared in 1845, produced a famine, especially in Ireland, where potatoes had for years been almost the sole article of food with the poorer class. Since that period, and on account of this disease, the crop has been uncertain throughout all countries.

Besides the usual culinary purposes for which potatoes are used, a large quantity of starch is manufactured from them, equal to arrow root, and used for many domestic purposes. It enters largely into the composition of the best wheaten bread, sometimes even to excess. From the starch is obtained a gum called Dextrine, which is used in the arts, and constitutes the adhesive matter used for letter stamps and envelopes. The potato yields by distillation a strong spirit, and by fermentation a wine is obtained; the spirit in flavour resembles brandy.

Egg-plant (*Solanum melongena*). A native of South

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* See page 102.

America, and now spread over the tropics. It was introduced to Britain in 1597; it is a tender annual plant, cultivated for curiosity; its fruit resembles an egg. There are several varieties, varying in colour from white to red, yellow or dull purple, and in shape more or less round or oblong. It is much cultivated in France, as also a sort called *Bringals*, of which French cooks make great use for culinary purposes.

Bitter-sweet (*Solanum dulcamara*). A slender-stemmed, straggling plant, growing abundantly in hedges, which in autumn it adorns with its bunches of beautiful red berries, that have the appearance of currants, and being sweet and tempting are often eaten by children, to whom serious consequences have often occurred. It is recorded that thirty berries killed a dog in three hours. This circumstance shows the necessity of guarding children against them.

A great number of virtues are ascribed to this plant even as far back as the time of Theophrastus, who called it *vitis sylvestris*. It is still in great repute amongst rustic as well as regular practitioners.

Apple of Sodom (*Solanum sodomeum*). A prickly species attaining the height of 2 or 3 feet, a native of Palestine, especially on the shores of the Dead Sea. It produces fruit like "faire apples," but when ripe is found to be full of dust like ashes, which is caused by an insect depositing its eggs in the young fruit, the larvæ destroying and pulverizing the whole of the inner part, leaving the rind entire and hard. This agrees with the description of the Apples of Sodom as given by Josephus and Tacitus, but it is more generally believed that the plant bearing the "faire apples" is the *Colocynth*, which see.

Solanum anthropophagorum. A soft brushy shrub, attaining the height of 6 feet, having dark-green leaves similar to the Love Apple. It is a native of Fiji, where its fruit figures in the cannibal feasts of the natives.

Chillies, or Guinea Pepper (*Capsicum annuum*). This originally came from India, but is now cultivated in all tropical regions. It is an annual plant, attaining the height

of about 12 or 18 inches. It is too tender for successful out-door cultivation in this country, but succeeds well and produces fine fruit under glass. There are several varieties, their fruit varying in shape and colour, being either long or short podded, red or yellow. There are also some distinct species, such as Cherry Pepper (*Capsicum cerasiforme*); Bird Pepper (*C. baccatum*); Bell Pepper (*C. grossum*); Spur Pepper (*C. frutescens*), a shrub—which are all, more or less, grown in different countries, and extensively used in cookery in hot climates, being considered beneficial in exciting the appetite. The dried fruit when ground constitutes Cayenne pepper. In this country they are greatly used as pickles, and in sauces.

Tomato or Love Apple (*Lycopersicum esculentum*). An annual weak trailing plant with soft stem, winged leaves and yellow flowers. It is a native of South America, and is cultivated in most warm countries for the sake of its fruit. It succeeds best in this country when trained against walls. There are several varieties, bearing large red or sometimes yellow fruit, which is used for culinary purposes, the well-known sauce called tomata sauce being made from them.

Winter Cherry (*Physalis Alkekengi*). A perennial plant, native of the South of Europe, having fruit like a small cherry, which becomes enclosed in the enlarged leafy permanent calyx; in some parts the fruit is eaten, but is much surpassed by what is called the Cape Gooseberry (*Physalis edulis*), a native of tropical America. It is a weak sub-erect plant with a soft stem; its fruit has a very luscious flavour and is very enticing to eat.

Mandrake (*Mandragora officinarum*). A perennial plant, native of the South and East of Europe and Western Asia; it has large tap roots, from which spring a number of simple lance-shaped leaves, the flowers being produced amongst them close to the stem and succeeded by the fruit, which lies on the ground round the centre of the plant; it is like the potato apple but larger. This plant is of ancient renown for virtues superstitiously founded on the resemblance of the

roots to the human figure. This idea of its virtues has prevailed since Reuben "found mandrakes in the field,"* but it is doubtful whether that was the same plant as the present. A few years ago two children were poisoned, it is said, by eating mandrake roots, which they found in a field. But whatever was the cause of death, it could not be from the effects of *Mandragora officinarum*, as it is not a native of this country.

Stramonium or Thorn Apple (*Datura stramonium*). A rude growing annual plant, having stiff spreading branches, attaining the height of 2 or 3 feet, and flourishing in rubbish heaps and waste ground. It has large oval leaves, entire or lobed, which are used for smoking as a remedy for asthma. It contains an alkali which is used medicinally, and a large prickly capsule that is prized for skeletonizing. Other species, such as *D. fastuosa* and *D. Metel*, natives of India, also grow freely in this country and possess the same properties as *Stramonium*. It is supposed that the seeds of *D. Stramonium* have the effect of producing delirium, and are said to have been used by the priests of Apollo at Delphi to produce their ravings, which were called prophecies. They are also used by the Thugs or poisoners in India to carry on their nefarious practices, and in this country for drugging.

Datura sanguinea is a soft-wooded shrub or small tree, having large orange-coloured tubular flowers which are very ornamental in the hothouses of this country. It is a native of Peru and parts of Central America. The Indians prepare a drink from the fruit (which is like the thorn apple) called Tonga, and by drinking it believe they are brought into communication with the spirits of their forefathers. In Darien a decoction of the seeds is given to children, which produces a state of excitement, and is supposed to give them the power of discovering gold; the effects bring on exhaustion, and wherever they fall, digging for gold commences.

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* Genesis, chap. xxx. ver. 14.

Henbane (*Hyoscyamus niger*). An annual erect weedy plant with soft broad leaves, growing both in cultivated and waste places. It is much valued in medicine, the chief preparation being an extract of the leaves, which is used in the place of opium; also by oculists for dilating the pupil of the eye.

Tobacco (*Nicotiana Tabacum*). The original country of this and other species producing tobacco is America, where its use was first discovered by Columbus in 1492, by whom on his return it was introduced into Spain, and by Sir Walter Raleigh into England in 1589. Although great objections to its use were raised by kings and popes, it nevertheless spread over Europe and all countries of the East. Tobacco now constitutes a most important article of commerce, being imported into England from various countries under different names and qualities. The great bulk comes from the United States, where it forms one of the chief articles of cultivation (till recently by slaves). The word Tobacco is said to be derived from the original name of the pipe used by the Carib Indians for smoking it. It is a handsome growing plant, attaining the height of from 4 to 6 feet, having broad, oblong or sharp leaves, and pretty pink, tubular or bell-shaped flowers. It grows freely in this country, but on account of excise restrictions is not cultivated to any extent.

The different methods of manufacturing and using Tobacco are too well known to be noticed here. Various kinds of snuff are made from the leaves first being dried and then ground to powder. No plant is of more extensive use, and it is calculated that one man out of every four uses it.

Deadly Nightshade (*Atropa Belladonna*). A strong growing perennial plant, native of this country and throughout Europe. It attains the height of about 3 feet, having broad oval leaves and solitary flowers of a brownish yellow colour, which are succeeded by a black-berried fruit, closely seated on the wide-spreading calyx; it is about the size of a small cherry, and when ripe has a glistening and enticing appearance and sweetish taste, but is extremely poisonous, fatal

accidents having occurred through its being ignorantly sold, even in the streets of London, for blackberries. The whole plant is poisonous, but is a useful and powerful medicine when properly used. Like henbane, it has the power of dilating the pupil of the eye. It is also called Dwal, and in olden times Dwal water was a favourite wash with ladies for removing freckles, hence its name "Belladonna," meaning Fair Lady.

Box Thorn (*Lycium barbarum*). A twiggy rambling shrub of rapid growth, native of countries bordering on the Mediterranean. It is often seen covering arbours in cottage gardens in this country. Its leaves resemble those of the Chinese tea tree, which led to its being brought into notice about one hundred years ago by the then Duke of Argyle as a substitute for tea, for which reason it received the name of the Duke of Argyle's tea tree.

(NOLANACEÆ.)

This family consists of about thirty species, natives of South America, chiefly Chili. They were originally considered to belong to Solanaceæ, from which they have been separated on account of their plaited corolla, and in having 5 or more distinct carpels united to a single pistil. The principal representatives of the family are *Nolana prostrata* and *N. paradoxa*, pretty garden annuals, with blue and yellow flowers; also *Alona cœlestis*, a frutlet with showy pale blue flowers. They possess no special properties.

The Sebesten Family.

(CORDIACEÆ.)

Hard-wooded trees or shrubs, having simple alternate generally rough leaves. Flowers usually in more or less one-sided panicles, cymes, or spike-like. Corolla 5-cleft, the lobes imbricate. Fruit a drupe with 4 or more cells.

Nearly 200 species are enumerated as belonging to this family, chiefly natives of tropical countries. A few only are

known to be of any special utility, being chiefly used as hard woods.

Spanish Elm (*Cordia Gerascanthus*). An erect branched tree of considerable size, native of the West Indies. It yields serviceable timber.

Sebestens. The name given in India to the fruits of *Cordia Myxa* and *C. latifolia*, which are eaten, and also used medicinally.

Anacahuite Wood (*Cordia Boissieri*). A tree, native of Mexico, the wood of which has been lately imported to this country as well as into Germany, and was once supposed to be a remedy for consumption.

About 300 species have been separated from Cordiaceæ, as a distinct family, under the name of *Ehretiaceæ*. They consist of small trees or shrubs, few of which are of any interest, except the well-known garden *Heliotropium peruvianum*, which, on account of its scent, is known by the name of "Cherry pie."

The genus is represented in Europe by Turnsole, *H. europæum*, *Tournefortia volubilis*, *T. cymosa*, and *T. humilis*, flowering shrubs, natives of the West Indies and tropical America. They have long been inmates of the hothouses at Kew.

THE GENTIAN AND NUX-VOMICA ALLIANCE.

The Gentian Family.

(GENTIANACEÆ.)

Annual or perennial herbs, floating aquatics, or soft, rarely hard-stemmed, frutlets. Leaves simple, rarely trifoliate, opposite, sessile, more or less sheathing and embracing the stem, generally with several prominent ribs running from the base to the apex; in the aquatics round and peltate. Flowers axillary, in tufts, or terminal spikes; or in few-flowered panicles, rarely solitary; generally showy, blue, white, yellow, red, or even black. Corolla tubular. Fruit

a 2-valved capsule, the margins of the valves turned inwards, containing numerous seeds, rarely a berry.

This interesting family consists of nearly 500 species, all widely spread over the earth, extending to the limits of vegetable life in the polar regions, and to the verge of perpetual snow and glaciers in elevated regions. They are also found in moist places in tropical countries. They contain a bitter principle, and most of them are used as tonic medicine in their different localities.

Gentian. This genus consists of a considerable number of species, many of which are favourites in gardens, such as the well known Gentianella (*Gentiana acaulis*), a native of the Alps, also said to be found wild in Wales. But the most important is *G. lutea*, a native of Switzerland. It is a showy growing species, with an erect leafy flower stem, attaining the height of 2 or 3 feet. The leaves are broad and strongly veined. Flowers yellow, axillary in tufts. The roots are strong, about the thickness of the finger, and highly valued as a tonic. Six species of the genus are natives of this country, three being annuals.

Chirata (*Ophelia Chirata* and *O. elegans*). Slender-branched annual plants, 2 to 3 feet high, with yellow flowers, natives of India, where the stems are held in high repute as a tonic and febrifuge, both by native and European practitioners.

Buck Bean (*Menyanthes trifoliata*). One of our most beautiful native plants, growing abundantly in marshy places, and by the sides of streams. It possesses strong medicinal properties, the leaves being extremely bitter. An infusion of them is a favourite domestic remedy in rheumatism, and is employed by regular practitioners in fevers. They have been used as a substitute for hops; but they give bitterness without the aroma of the hop. Another equally interesting native plant is *Villarsia nymphœoides*, which grows in ditches and ponds. It has long stalked, floating, peltate leaves, and pretty yellow flowers rising above the water.

Several species of *Lisianthus*, natives of the West Indies and Tropical America, have been introduced. *L. Russel-*

lianus is very showy, having large light blue spreading flowers. Allied to the preceding is the small family (*Diapensaceæ*). It consists of three known species represented by *Diapensis lapponica*, native of Lapland, and *Pyxidanthera barbulata* of North America. Small prostrate frutlets of the habit of small leaved *Saxifraga*, having solitary, pretty, white or pink bell-shaped flowers; they are only interesting botanically.

The Nux-Vomica Family.

(STRYCHNACEÆ.)

Small trees or shrubs, rarely herbs. Leaves opposite, simple, with sheathing stipules, sometimes united to the petioles. Flowers solitary, spiked, or in racemes. Corolla regular or irregular, inconspicuous, or large and showy, stamens in some 4. Fruit a 2-celled capsule or berry, or with a hard shell (pepo-like) with the seeds immersed in pulp.

This family consists of nearly 200 species, all widely distributed throughout tropical countries, a few extending beyond. They exhibit extreme differences in habit and appearance; some contain a most deadly poison.

Worm Grass or Pink Root (*Spigelia marilandica* and *S. Anthelmia*). Pretty herbaceous plants about a foot in height, having spikes of pink flowers. Their roots are powerful purgatives, and were at one time much used as worm medicines.

Nux-vomica (*Strychnos Nux-vomica*). A small, straggling, branched tree, native of India. It has opposite sessile leaves that have several strongly marked veins running from the base to the apex. The flowers are small, and the fruit resembles an orange, but has a hard rind and contains numerous round, flat seeds like broad beans, embedded in pulp, and when dry have a covering of white silky hairs. The kernels of these seeds contain two most deadly poisons, *Strychnine* and *Brucine;* but the pulp is wholesome. The bark and roots are extremely bitter, and are favourite

remedies amongst the natives for snake bites, and are also used in fevers.

Strychnos toxifera. A native of British Guiana and upper regions of the Orinoco. It is similar in habit to the last, but has larger leaves. The famous arrow poison of the natives called "Ourari, Wourali, and Curarie," is obtained from the bark and alburnum, which is stripped off and macerated in water. After lying some time the water is evaporated, when a black sediment resembling tar is left. This substance is harmless when eaten, but is fatal when it comes in contact with the blood through wounds. The flesh of animals poisoned by it is nevertheless perfectly wholesome.

Clearing Nut (*Strychnos potatorum*). A small tree, native of India. It has hard wood which is used for various economic purposes; but it is most remarkable for its fruit, which is black, about the size of a cherry, and contains one seed. The seeds are dried, and then used to clear muddy water, which is effected by rubbing one of them round the vessel that is to contain the water, which, being then poured in, quickly becomes clear.

Snake-wood (*Strychnos colubrina*). A native of India, Java, and other islands. In Malabar it furnishes the wood called snake-wood. It is in great repute as a remedy for the bites of snakes, and in skin diseases.

The genus *Fagræa* consists of soft-wooded trees of a shrub-like, epiphytal nature, having angular branches and thick, laurel-like leaves, with a sheathing attachment. They are natives of India, the Malay and other islands, and are ornamental plants, some of them having showy flowers. Six species have been cultivated at Kew.

Fagræa Berteroana is a hard, white-wooded tree, native of Fiji, having thick, fleshy flowers which are highly odoriferous, and used by the natives, when fresh, for scenting cocoa-nut oil; when dry they are made into necklaces.

† † † Corolla regular; stamens 2, 4, 8, 16, or 5, 10.

THE HOLLY, JASMINE, AND EBONY ALLIANCE.

The Aderno-tree Family.

(Myrsinaceæ.)

Evergreen shrubs or small trees with alternate simple, firm, smooth, entire, or spiny leaves, often with transparent dots. Flowers in lateral spikes or loose umbels. Corolla generally of a firm texture and dotted. Fruit a hard firm berry.

About 320 species are enumerated as belonging to this family. They are widely distributed, abounding in the Islands of the Indian and Pacific Oceans, extending to New Zealand, and also found in Madeira and the Azores. None are natives of Europe. They possess no special medicinal qualities, but many are ornamental as hothouse and greenhouse plants.

Aderno tree (*Ardisia excelsa*). A small sized hard-wooded tree, native of Madeira. It forms a bushy head with shining laurel-like leaves, but it is of slow growth, a plant at Kew, fully seventy years of age, having attained the height of only 8 feet. In cultivation, *A. crenata* forms a small bush 2 to 3 feet high; it has shining green leaves, and bears a profusion of red coral-like berries, which give it an ornamental appearance in greenhouses. *A. paniculata*, *A. solanacea*, *A. humilis*, and *A. hymenandra* are also ornamental species.

Jacquinia armillaris, a native of the West Indies, and *J. aurantiaca* of the Sandwich Islands, have been long known in this country as pretty shrubs. In the West Indies the first is called Bracelet-wood, its hard berries being used for making bracelets.

Theophrasta Jussiæi. An erect single-stemmed shrub or small tree, native of St. Domingo, having rigid spiny leaves 2 feet in length and about 2 inches broad, their edges being prickly like Holly leaves. The flowers are bell-shaped, of a brownish colour, and on first opening emit a peculiar

mawkish odour. The plant is rare in this country, and is of slow growth, one at Kew 40 years old has attained the height of only 7 feet.

Myrsine africana, a native of Eastern and South Africa; *M. retusa*, of the Azores, where it is called Jamassa; they form handsome greenhouse shrubs, and live to a great age.

The Holly Family.

(AQUIFOLIACEÆ)

Trees or shrubs, with alternate generally permanent, often spiny leaves. Flowers small, solitary or in clusters, generally axillary, sometimes dicœcious, sessile or on short peduncles. Corolla 4-lobed. Stamens 4 or 6. Fruit a fleshy berry, containing several hard seeds.

This family consists of above 100 species, all widely distributed, both in tropical and temperate countries, being represented in Europe by the well known Holly tree.

Holly (*Ilex Aquifolium*). The common green-leaved Holly is a native of middle and southern Europe, as also of this country. It sometimes attains the height of 30 or 40 feet, and has white wood, which is held in repute by cabinet-makers and turners. It is often blackened so as to resemble ebony, and is then used for making teapot and knife and fork handles. Common birdlime is made from its bark. It is much planted as an ornamental tree, as well as for forming hedges, the numerous gold- and silver-leaved varieties being obtained by cultivation. Although its berries afford abundance of food for birds, they are nevertheless poisonous, fatal cases having been recorded through children eating them. The use made of Holly and other evergreens for ornamenting churches and dwelling houses at Christmas is well known, but the origin is uncertain; it is said to have been practised by the Druids. It was a custom with the Romans to send sprigs of Holly with their gifts to their friends during the Saturnalia as an emblem of good wishes. This was adopted by the early Christians, and the first

record of its having been practised in England, is in the reign of Henry VI.

Paraguay Tea or Yerba (*Ilex paraguayensis*). A small tree with plain or toothed leaves, native of South Brazil, in the countries of the Parana and Paraguay rivers. The leaves are scorched and pounded, and become the tea which forms an important article of trade in South America, taking the place of Chinese tea, as used in other countries. It is infused in the same manner, but is drunk in a different way, being sucked through a tube, and is extremely refreshing after fatigue. Maté is the name of a small gourd, which forms the drinking cup.

Black drink of the Indians (*Ilex vomitoria*). This plant is in great repute, and is reckoned a holy plant by the North American Indians. Of the leaves slightly scorched they make the black drink used during their religious rites and solemn councils to clear the head and stomach.

The Star Apple Family.

(Sapotaceæ.)

Trees or shrubs with alternate, simple, smooth, firm leaves, containing a milky juice. Flowers axillary. Corolla variously lobed. Calyx persistent. Stamens variable. Fruit a fleshy drupe, generally containing 1 or more hard smooth-shelled seeds, with a scar on one side.

This family consists of above 200 species, all widely distributed throughout the tropical regions. They are of great importance for their fruit, as well as for a milky juice, which furnishes gutta percha.

Star apple (*Chrysophyllum Cainito*). A tree from 30 to 40 feet high, native of the West Indies. It has spreading branches, and beautifully veined leaves of a silvery white on the under side. The fruit is about the size of an apple, and is wholesome, having an agreeable sweet flavour; it consists of ten cells, each containing a single seed, and when cut across (before the seeds harden), has a star-like appearance,

whence its name. It is an ornamental plant in greenhouses.

Sapodilla Plum (*Achras sapota*). A large tree, native of the West Indies, where, as well as throughout all parts of tropical America, it is cultivated for its fruit, which is considered to be only inferior to an orange ; it is about the size of a Bergamot Pear, and is not fit for eating until it begins to decay.

Achras (*Lucuma*) *mammosa*. A large tree, native of the West Indies and tropical America. Its fruit is from 3 to 5 inches long, and pulpy. It is sometimes called marmalade, from its resembling that substance in taste and appearance.

The two last-mentioned are also known by the name of Bully Trees, and are cultivated in the Mauritius, and other parts of the east.

Cainito (*Lucuma cainito* and *L. obovato*). Large trees, natives of North Chili and Peru; but there are some doubts whether they are distinct species. The fruit is not so large as that of the preceding, but of a more agreeable flavour, and is much esteemed in Peru. *L. obovato* has fruited at Kew.

Gutta Percha (*Isonandra gutta*). A tree attaining the height of from 60 to 70 feet. It has smooth ovate entire leaves, of a rusty brown colour on the under side. It is a native of the Malayan Peninsula, Borneo, and other islands. It contains milky juice, which forms gutta percha. This substance came into special notice in 1845, and its important uses soon becoming obvious led to a great demand for the article, to meet which the natives cut down the trees. It is consequently now extinct in Singapore, from whence it was first obtained; and if precaution is not taken by Government, it will in time become extinct in other localities.

The numerous uses to which gutta percha is applied are well known ; the most important is for covering the electric wires of telegraph cables, it being a perfect insulator, and also said to be indestructible under water.

A number of other trees of this family yield gutta percha in varying abundance and quality. The best is obtained from *Sapota Mulleri*, a large tree, native of British Guiana,

and apparently also of Surinam, and called *Ballata*. It is imported in large quantities from that colony, and considered equal to the best gutta percha of the east.

A tree called "*Massaranduba*," or Cow Tree of Para (*Mimusops alata*), is probably of this family. It is described as a lofty tree, attaining the height of 100 feet; and on incisions being made in the bark, a milky juice flows most copiously from it; it is about the consistence of thick cream, from which, but for a slight peculiar flavour, it can scarcely be distinguished. By exposure to the air it thickens, and forms an adhesive glue, something like gutta percha. The fruit is about the size of an apple, very juicy, and is sold in the markets of Para. The timber is very hard, and used for many purposes.

Black Bully Tree (*Bumelia nigra*). A large tree, native of Jamaica, and indigenous in Barbadoes. The fruit has an agreeable flavour.

Argan Tree (*Argania sideroxylon*). A low, spreading tree, of a shrubby nature, often growing as a bush, having very small leaves. It is a native of Morocco, and western parts of North Africa. The fruit is about the size of a small Orleans plum, and is so abundant that it is collected and used for feeding cattle, the skin and pulp being much relished; but in chewing the cud they eject the hard kernels, which are collected and crushed, when an oil is obtained from them.

Butter Tree (*Bassia butyracea*). A middle-sized tree, native of Nepaul, and other parts of India. By pressure the seeds yield an oil of a fatty nature, which thickens and becomes like lard; it is used for culinary purposes, also for making soap, and by the natives of rank as an unction. It is also known by the name of "Chooree," and forms a considerable article of trade. The flowers abound in honey, scarcely differing in the raw state from hive honey, except that it is more limpid. It is manufactured into sugar, in every respect equal to that of the sugarcane.

Bassia latifolia. A native of Bengal, and other parts of

India. Like the preceding the seeds yield a fatty substance, called Ghee, used as butter. An ardent spirit similar to whisky is distilled from the flowers, which has proved as injurious to European soldiers as the new rum of the West Indies. They are eaten raw by the natives in the district of Circars, and are also dried and preserved, forming a considerable article of food.

Shea, or Butter Tree of Africa (*Bassia Parkii*). A tree, native of West tropical Africa. It attains the height of from 60 to 90 feet, and a diameter of from 6 to 9 feet. The leaves are large and bright green; the fruit is about the size of a peach, but more oblong, consisting of sweet pulp containing a bony seed with a kernel, which after being separated from the shell is pounded and boiled, when a fatty substance swims on the top of the water, which is skimmed off, and when cold resembles butter. It was first brought into notice by Mungo Park, who found the trees abundant in the kingdom of Bambarra. It is a great article of trade with the natives, and forms an important part of their food. Shea butter has the consistence of tallow, is of a pale lemon colour, and has an aromatic taste. It is expected that when the interior of Africa is more open, it will become an article of trade to this country.

The Ebony Family.

(Ebenaceæ.)

Trees or shrubs, with alternate, simple, entire, generally firm leaves. Flowers mostly axillary and solitary; unisexual or bisexual. Corolla urceolate, 4-dentate or cleft. Fruit pulpy, round or oblong, drupe-like; generally few-seeded.

About 160 species are enumerated as belonging to this family, the principal being found within the tropics, chiefly in the eastern hemisphere; represented in Europe and North America by *Diospyros*.

Date Plum (*Diospyros Lotus*). A low-growing tree, native of the South of Europe. It produces a small drupe, which is

supposed to be one of the fruits eaten by the people called Lotophagi.

Persimmon or American Date Plum (*Diospyros virginiana*). A tree, native of the United States. It attains the height of 50 or 60 feet, and has rough corky bark, and unisexual or bisexual flowers. The fruit is nearly round, about an inch in diameter, and of a yellowish orange colour; it is very austere, but after being frosted is eatable. They are pounded and made into cakes from which a kind of beer is prepared, and a spirit is obtained by fermentation and distillation. The tree is rare in this country. One 40 feet high and one hundred years old may be seen at Kew, which in some seasons produces fruit.

Chinese Date (*Diospyros Kaki*). A tree, native of China and Japan, where as well as in India it is cultivated for the sake of its fruit, which is about the size of a small apple; it is said to be delicious, and is made into a preserve. It has been introduced into Egypt, whence it is called Lotus tree. It has fruited at Kew.

Ebony. This is furnished by several species of *Diospyros;* Ceylon ebony by *D. Ebenum;* Indian ebony by *D. Ebenaster* and *D. melanoxylon;* the best, however, comes from the Mauritius, and is the produce of *D. reticulata.* They are large but slow growing trees with firm dark-coloured leaves. With age the wood becomes hard and black and is then known as ebony. Ebony is mentioned in the Bible* as an article of merchandize obtained probably from Ceylon.

Calamander Wood (*Diospyros quæsita*). A large tree, native of Ceylon, having beautiful hard wood much prized for making boxes and other ornamental articles.

Mabola (*Diospyros mabola*). A native of the Philippine Islands, and commonly cultivated in many Islands of the East; it has also been introduced into the West Indies. It is a middle sized tree, having large firm coriaceous leaves of a light colour. The fruit is like a large quince, and in some places is often called Mangosteen; its flavour is agreeable.

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* Ezekiel, chap. xxvii. ver. 15.

The family is represented in New South Wales by *Cargillia australis* and *C. arborea*, hard-wooded trees, the latter attaining the height of nearly 100 feet; the fruit is called the grey plum, but is not very palatable. Different species of *Royena* represent the family in South Africa.

The Olive Family.

(OLEACEÆ.)

Lofty, or middle-sized trees or shrubs, generally much branched, the young branches flat or angular. Leaves opposite, simple or winged. Flowers rarely unisexual. Corolla 4-lobed or cleft; sometimes absent. Stamens generally 2. Fruit a drupe as in olive; a dry capsule as in *Syringa*, or a winged samar as in *Fraxinus*.

This family consists of nearly 150 species, all widely distributed over the temperate regions chiefly in the northern hemisphere, where they are represented by *Fraxinus* (Ash), *Olea* (Olive), *Syringa* (Lilac), *Phillyreas* and *Ligustrum* (Privet); the latter the only one of the family native of this country; and in the southern hemisphere by *Notelea* and *Olea*, and in North America by the beautiful shrub Fringe-flower (*Chionanthus virginica*).

Olive (*Olea europea*). Although this receives the specific name of europea, yet it is doubtful whether it was originally native of Europe, but it is well known to be a native of Western Asia. It is a small shrub-like branching evergreen tree, somewhat spiny, having smooth or slightly hoary, stiff leaves about the size and shape of tea-leaves, producing in their axis tufts of small white flowers, followed by an oblong drupe or berry-like fruit. It is a very long-lived tree, growing in the most barren, dry places, and is extensively cultivated in all countries bordering on the Mediterranean. Olive oil is obtained by expression from the pulp of the fruit, and is imported to this country from Italy and other ports of the Mediterranean. Salad or Florence oil comes in flasks enclosed in wicker-work. The unripe fruits are pickled.

The oil produced from the olive plantations of Palestine formed a lucrative article of trade with the Tyrians. In 1 Kings* it is stated that Solomon gave Hiram, King of Tyre, "twenty measures of pure oil." In the present day Hebron is celebrated for its olive orchards. Recent travellers describe seven olive trees as growing at Gethsemane which, judging from their description, is sufficient to warrant the supposition that they were trees at the time Christ "went as He was wont to the Mount of Olives." One of the chief trades with Jerusalem in the present day consists of chaplets and small toy articles, many of which are made of olive wood. A branch of olive is considered an emblem of peace.

Manna, or Flowering Ash (*Fraxinus ornus*). A much branched tree, native of the South of Europe and Palestine. It attains the height of 25 or 30 feet, and produces spikes of pretty white flowers, the narrow petals and stamens giving it a fringe-like appearance. It yields the substance called manna, which is obtained by making incisions in the bark, when the juice exudes and hardens.

The tree is cultivated in the south of Italy and Sicily, from whence manna is imported, and is used as a mild purgative. In this country it forms an ornamental tree.

Ash (*Fraxinus excelsior*). This noble and valuable timber tree is native throughout Europe, some parts of Western Asia and North Africa. It lives to a great age, and is extensively planted in this country for its timber, which, on account of its hardness and toughness, is used for all purposes where tenacity is required, such as garden and agricultural implements, also when young for making hoops.

Fraxinus chinensis. A small tree, native of China; it is remarkable from a species of *Coccus* insect living on it, and being so abundant on the branches as to give them the appearance of being covered with flakes of snow. The insect perforates the bark and imbibes the juice of the tree, its body as well as the branch of the tree becoming a waxy mass, which

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* Chap. v. ver. 11.

is scraped off, and after boiling, forms a wax like beeswax or spermaceti. It has been imported to this country, but is too expensive for common use. Several shrubs of this family are said to produce this wax.

Wax Tree (*Ligustrum lucidum*). A small tree or handsome shrub, hardy in this country. It is a native of China. An insect that deposits a wax is said to feed on it. This is well known to be the case with *L. Ibota*, a native of Japan, which is cultivated for that purpose.

Tasmanian Iron-wood Tree (*Notelæa ligustrina*). A native of New South Wales, Victoria, and Tasmania. This generally forms a tree 30 or more feet in height, with a trunk sometimes a foot or more in diameter, but is often seen as a bush. Its wood is very hard, and is used for making ship blocks and for other purposes where hardness is required. It is nearly hardy in this country.

Lecnociera ligustrina. A tree, 40 feet high, native of Jamaica; by some called Jamaica rosewood. The wood is very hard and fragrant, and is excellent timber.

The Jasmine Family.

(JASMINACEÆ.)

Erect trailing or twining shrubs. Leaves opposite or alternate winged, or simple, with a joint in the petiole. Flowers axillary or in terminal umbel-like tufts, yellow or white. Corolla spreading, 5 or 8-lobed. Stamens 2. Pistil bifid. Fruit binate, berry-like, as in *Jasminum;* or a 2-celled dry capsule, as in *Nyctanthes.*

This was originally considered to be a part of Oleaceæ, but on account of a slight difference in the structure of the corolla and seed, modern botanists have thought proper to make a separate family of it. The number of species amount to 100 or more, and are widely distributed, different species of *Jasminum* being natives of Europe, India, China, and Australia.

Jasmine (*Jasminum officinale*). The native country of the

white Jasmine is said to be India, but it is now wild throughout many parts of Southern Europe, and is well known in this country for forming arbours, its sweet-scented flowers causing it to be a great favourite. Oil of Jasmine is obtained by soaking cotton in oil of Ben, and placing flowers of Jasmine amongst it, and after lying for some time the oil is pressed out having the odour of Jasmine.

Jasminum Sambac, *J. azoricum*, as well as several simple-leaved species from India, and two from Australia, are ornamental creepers in the hothouses of this country, while *J. nudiflorum* and *J. revolutum* are hardy wall shrubs, the yellow flowers of the former being conspicuous in early spring.

The Snowdrop Tree Family.

(STYRACEÆ.)

Small trees or shrubs, with alternate, simple deciduous leaves. Flowers white, axillary solitary or several together, generally pendulous on long footstalks furnished with small bracts. Stamens irregular in number, sometimes partially united. Fruit drupaceous, or dry and winged.

About 115 species constitute this family, which are widely spread, chiefly within the tropics of India and America.

Snowdrop Tree (*Halesia tetraptera*). A wide-spreading branching tree, attaining the height of from 20 to 30 feet, native of North America. It produces a profusion of pendulous white flowers like snowdrops, which render it a highly ornamental tree.

Storax (*Styrax officinale*). A small tree, or sometimes shrub, native of Levantine countries. By incisions the bark yields the gum called gum storax, which is well known as a perfume, and is used as incense in Roman Catholic churches. It grows abundantly in Palestine, and is considered by some commentators to be the Poplar rod of Jacob, but its nature of growth is such that its branches can scarcely be called rods.

Benzoin (*Styrax benzoin*). A tree, native of Sumatra and other Malayan Islands. Gum benzoin is obtained by incisions

made in the bark. This is a highly valued perfume, and is also used as incense, and as a medicine for pulmonary complaints.

Styrax punctatum. A tree, native of Veraguas in Central America. It yields a gum, which is obtained after the tree is cut down and allowed to remain several years on the ground, when the external part of its wood is removed, and the gum resin found collected in greater or smaller masses. It is used as frankincense.

Symplocos racemosa. A small tree, about 20 feet high, native of several parts of India. The bark is used with munjeeth for dyeing. It is called Lodh Bark. The leaves of most species of *Symplocos* turn yellow with age; *S. tinctoria*, native of Georgia and Carolina, is used for dyeing yellow. *S. Alstonia*, a branching tree growing 10 or 12 feet high, native of New Grenada, very much resembles the Chinese Tea Plant; it has been long used for that article, and is considered to have medicinal virtues.

† † † † Corolla regular. Stamens hypogynous (*Ericaceæ*) or perigynous (*Epacridaceæ*).

THE HEATH, EPACRIS AND WINTER-GREEN ALLIANCE.

The Heath Family.

(Ericaceæ.)

Trees or shrubs, varying considerably in appearance. Leaves simple, alternate, opposite or whorled, small and needle-like, as in Heaths; or large and broad, as in Rhododendron. Flowers solitary, or in erect or pendulous spikes, racemes or umbels. Corolla tubular, urceolate, campanulate, or wide and spreading; toothed, lobed, or deeply cleft, as to be almost polypetalous; the lobes sometimes unequal. Stamens 5, 8, or 10 hypogynous; anthers opening generally by a pore in their apex. Fruit a 5 or more celled dry capsule; or fleshy and berry-like.

This interesting family consists of nearly 900 species, all

widely distributed over the earth, the genus *Erica*, of which there are 380 species, forming a feature in the Flora of South Africa, as well as throughout Europe and the North of Asia; the genus *Rhododendron* occupying a considerable extent in the Himalaya and elevated regions of the Malayan Archipelago, as also in China, Japan, and North America. In the Andean regions of tropical America, *Befaria* and *Andromeda* represent the family; and in Australia and Tasmania, *Gaultheria*. A narcotic and poisonous principle pervades this family.

Heather Ling (*Erica vulgaris*). This is the common Heath which covers extensive tracts of hills and moors in this country, especially in Scotland. It has no special use except for making heather brooms, thatch, and the like; the flowers afford excellent honey, and beehives are often carried from the low country to the Heath localities during the flowering season.

Cape Heaths. At one time the botanical collections in this country contained nearly 200 species of Heaths, but new varieties having been raised by hybridising, which have become popular show plants, the less showy species have been neglected.

The genus *Rhododendron* consists of a great number of species, varying considerably in habit and size, some being trees with large broad leaves, others trailing, partially epiphytal shrubs, and others heath-like. All have showy, and many of them splendid flowers.

Rose Tree (*Rhododendron ponticum* and *R. maxima*). The first is a native of Western Asia and the latter of North America, both having been introduced into this country more than one hundred years ago. They are now superseded by numerous fine varieties raised in this country, and of late years a great number of allied species of the same habit of growth have been introduced from Sikkim, Bhootan, Java, &c. But few of them are of sufficient hardiness to bear the open air of this climate. Amongst the Sikkim species are many that form trees of considerable size, of which the *R. arboreum* is the original type; it is a native of Nepal, and

was introduced in 1818; there are now two fine plants of it at Kew. It is not quite hardy in the neighbourhood of London, but is so in Cornwall and Jersey; it has a splendid appearance when in blossom, and the scarlet flowers contain a quantity of honey, which in its native country is made into jelly. Others of the Sikkim species attain a large size, even to the height of 40 feet.

Azaleas, Yellow Azalea (*Azalea pontica*). A native of Pontus in Asia Minor, and first introduced to this country about seventy years ago; the original plant is still growing at Kew. Its flowers are fragrant, but are, as well as the leaves and honey, of a poisonous nature. It is believed that the honey from this plant was the cause of the illness of the Greek soldiers in the retreat of the ten thousand. The white and red Azalea (*A. indica*) is a native of China. They live in the open air in this country, but make a poor appearance compared with the splendid specimens grown in the greenhouse, and as seen at horticultural flower-shows.

Kalmia latifolia. A native of North America, is a beautiful flowering hardy evergreen shrub. In its native country the honey from its flowers is poisonous, and the flesh of game feeding on the berries is also poisonous. In 1790, great mortality took place at Philadelphia, ascertained to be caused by eating honey from, and game that fed on *Kalmia* berries, which led to a public proclamation prohibiting the use of either honey or game.

Andromeda. A beautiful genus of evergreen shrubs; several species, natives of North America, form ornamental bushes in this country. *A. polifolia*, a native of, and abundant in bogs in the north of England and Scotland, is said to be poisonous to sheep.

Strawberry Tree (*Arbutus Unedo*). A native of Southern Europe and North Africa, and is much cultivated in this country as an ornamental shrub. The fruit, when ripe, resembles the Strawberry, but is not very palatable. *Eat one*, as the word *unedo* implies, and it will be enough. In severe winters it is often killed to the ground. It has become

naturalized about the lakes of Killarney in Ireland, where it attains the size of a small tree, one having been measured 9½ inches in diameter.

Shallon (*Gaultheria shallon*). A native of North-West America. It is a low evergreen shrub, a foot or more in height, having round leaves, and by its running underground shoots covering a considerable extent of ground. It generally grows in Pine forests, and produces an immense number of purple berries, which are made by the natives into bread. A smaller species, *G. procumbens*, is also a native of North America, and grows like the preceding. Its calyx becomes a fleshy berry, and affords food for game. In the United States it is called Partridge-berry, as also Wintergreen. It has a peculiar spicy and aromatic odour, and has been used as a substitute for tea. The odour is due to a volatile oil which is obtained by distillation, called Wintergreen oil, and is used medicinally as a stimulant.

Bear-berry (*Arbutus uva-ursi*). A low trailing evergreen shrub, with small leaves, abounding in mountainous districts throughout Europe and North America. In this country it is found in Wales, and is abundant in the Highlands of Scotland; it has red berries, which afford food for grouse, and in Sweden, Russia, and America for bears. The whole plant is astringent, and is used for tanning and dyeing.

Allied to Ericaceæ is a small family called Cyrillaceæ. It consists of about six species, natives of tropical America and Southern United States. They are neat simple-leaved shrubs or small trees, of the nature of *Andromeda*, differing from Ericaceæ by their anthers opening by slits, and in the corolla being apparently polypetalous, and are therefore by some botanists placed in the Barberry alliance.

The Winter-Green Family.

(Pyrolaceæ.)

Pretty little evergreen low shrubs, spreading by underground running stems. Leaves alternate simple. Flowers

in spikes or racemes, rarely solitary. Corolla urceolate, deeply cleft. Stamens 10. Fruit a dry 4 or 5-celled capsule.

About 20 species are contained in this family, all having bell-shaped flowers like some Heaths. They are natives of North America, Europe, and Northern Asia, and are generally found growing in fir woods. The principal number of species come under two genera (*Chimaphila* and *Pyrola*); 6 species of the latter being natives of this country, but confined to only a few localities. *Chimaphila maculata* is a pretty, somewhat variegated-leaved shrub, about 1 or $1\frac{1}{2}$ foot in height, growing in tufts. The whole are interesting as pretty, neat plants, and differ only from the Heath family in the corolla being generally divided to the base, not truly monopetalous.

Although the curious native plant Fir Rape (*Monotropa hypopitys*) differs widely from Heaths and Rhododendrons, the character of its flowers nevertheless brings it within this alliance. The whole plant consists of a fleshy few-flowered scape, furnished with scale-like bracts: the whole being of a pale or brownish colour. Corolla partially polypetalous, 5-lobed. Stamens 10, hypogynous. It is generally considered to be parasitic on the roots of trees, and is found in masses in fir and beech woods. By some botanists it is considered to be a type of a distinct family, Monotropaceæ, of which there are about 8 or 10 species distributed over the northern temperate zone. They have no special use.

The Epacris Family.

(Epacridaceæ.)

Small trees or shrubs. Leaves alternate, simple, distant or contiguous, and sheathing at the base, overlapping each other, rarely verticillate with longitudinal veins. Flowers solitary, terminal or in spikes, or in the axis of the leaves; white or red. Calyx often coloured and persistent. Corolla short, spreading, tubular or urceolate, sometimes becoming

5-parted. Stamens 5, perigynous. Fruit a succulent drupe, berry or capsule.

This family consists of about 300 species, the greater number of which are natives of Australia, Tasmania, and New Zealand, where they represent the Heaths of South Africa. A few are found in the Islands of the Pacific and Malayan Peninsula and Islands. They have generally harsh leaves, and form the scrub of the country; many have pretty flowers, and are cultivated in greenhouses, such as different species of *Epacris*, *Styphelia*, *Leucopogon*, *Drachophyllum*, &c. They possess no particular properties, except that the succulent fruits of some are not unwholesome; for example, *Leucopogon Richei*, *Astroloma humifusum*, *Stenanthera pinifolia*, and several *Lissanthe*, *L. sapida*, known in Sydney by the name of Australian Cranberry. The most woody species of the family is *Trochocarpa laurina*, a native of New South Wales, a tree attaining the height of from 15 to 18 feet, having hard wood.

The genus *Richei*, of which there are four species, three being natives of the mountains of Tasmania, present a remarkable appearance. *R. pandanæfolia* has a slender stem, attaining the height of 40 or 50 feet, with a diameter of about 9 inches at its base, bearing a crown of long, harsh leaves, similar to those of the Screw Pine, and having more the appearance of a *Dracæna* than as belonging to the family of *Epacris*. *Drachophyllum attenuatum* is of the same habit, but more slender. It is a native of New Zealand.

** *Corolla monopetalous, superior (epigynous). Stamens epigynous or perigynous.*

The Cranberry Family.

(Vacciniaceæ.)

Small trees, or much branched shrubs; some partially epiphytal. Leaves simple, alternate, some with marginal glands. Flowers solitary, or in racemes; sometimes sessile

on the stem. Corolla urceolate, tubular, or deeply cleft and spreading, toothed or lobed. Stamens 4, 8 or 10, epigynous. Fruit a berry, crowned with the withered calyx.

The general habit and nature of this family shows it to be intimately related to the Heath Family, but differing in the important character of the corolla being superior, thus showing that the adoption of a special character for classification is not always favourable to the union of families otherwise naturally related; and as Vacciniaceæ does not associate well with the following families, I deem it best to consider it as naturally part of the Heath alliance.

About 200 species are recorded. They are widely distributed over the temperate countries of Europe, Asia, and America; also found in the Andean regions of South America, but none in Africa or the south temperate zone.

Bilberry or Blaeberry (*Vaccinium myrtillus*), Whortleberry (*V. uliginosum*). Small branching shrubs, about a foot in height. They occupy vast tracts in bogs and moorlands, and even the tops of mountains throughout Europe and North America. Their berries are blueish, about the size of currants, and afford abundance of food for moorfowl; they are somewhat austere, but are used as a preserve for tarts, &c.

Cowberry (*Vaccinium vitis-idœa*). A neat, tufty evergreen shrub, having leaves resembling box-tree leaves. It grows in similar places to the last, and seldom exceeds 6 inches in height. It has abundance of red berries, which are also used for preserves.

Cranberry (*Vaccinium oxycoccus*). This differs from the preceding, being a trailing, slender-stemmed evergreen shrub, with narrow, lanceolate leaves. It generally grows in mountainous districts, and in boggy places in Scotland and Ireland. It differs from the rest of the genus in having its corolla cleft to the base and spreading, which character has led some botanists to separate it as a distinct genus, viz., *Oxycoccus palustris*. *Vaccinium macrocarpum*, of North

America, is of the same habit, but has a larger fruit. The berries of both are extensively collected, and used in tarts, &c. *V. ovatum* is a bushy species extremely abundant throughout North America. The berries are collected before they are ripe, and preserved by the North-West Indians for winter food. Several species of *Vaccinium* are also natives of the tropics, such as *V. erythrinum* and *V. Rollinsonia*, of Java, and *V. Imrarana*, of Dominico, pretty greenhouse shrubs. But the most remarkable of the family are species of *Thibaudia*, a beautiful genus, native of Sikkim, Himalaya and Bootan. They are rhododendron-like shrubs in general, having a thick gouty root-stock of an epiphytal nature; mostly found growing in moist mossy places. Several species have been introduced, of which *T. pulcherrima* and *T. macrantha* are conspicuous; they produce numerous sessile, tubular flowers on the stems; the flower of the latter is 2 inches in length, and 1 inch in width, nearly white, striped with red.

Species of the genus *Macleania* and *Ceratostemma*, natives of the Andean regions of Peru, are similar in habit to *Thibaudia*.

THE HONEYSUCKLE, COFFEE, AND WOODRUFFE ALLIANCE.

The Quinine Family.

(CINCHONACEÆ.)

Trees, or erect or climbing shrubs, small frutlets or herbs. Leaves opposite, simple, furnished with permanent stipules. Flowers inconspicuous, or large and showy, sometimes sessile on the branches, or in heads, spikes, panicles, or corymbs. Corolla bell-shaped, tubular, trumpet-like, or deeply cleft. Stamens 4 or 5. Fruit berry-like, splitting in two, or large, hard, and drupe-like, containing 2 or more seeds.

This extensive family consists of more than 2500 species; the greater portion being natives of the torrid zone; a few extending beyond, in both hemispheres. It con-

tains many plants useful in their respective countries, but only a few are of general importance.

Coffee (*Coffea Arabica*). A small, much-branched tree, which, when grown singly, attains the height of 20 feet, and much resembles a cherry tree, but has papery white bark and branches more slender and horizontal. It has opposite leaves of a light green colour, and elliptical lance-like form, about 6 inches in length. The flowers are in clusters in the axis of the leaves, and are white, like orange flowers, and perfume the air. The young fruit is first of a green colour, but on ripening becomes red, and is about the size of a small cherry, each containing 2 seeds closely united by their flat sides, which, on the pulp being removed, separate, and constitute coffee berries. Much has been written on the history and use of Coffee. From the best accounts there appears little doubt that it is a native of Abyssinia, and derives its name from a province in that country, called Caffa, where it appears to have been known from time immemorial. It was introduced into Arabia about the end of the fifteenth century (or probably much earlier). It became indigenous there, and furnished the supply of coffee for a considerable period to the Turkish capital and Western Europe; being shipped from Mocha, whence the name of "Finest Mocha Coffee." Coffee is said to have been first used in London by a Smyrna merchant, who, in order to have it properly prepared, brought with him a Levantine girl, who subsequently married his coachman, when they opened the first coffee-shop in London, in 1652.

The plant was introduced into Holland; and in time one was conveyed to the Dutch settlement of Surinam. It is also said to have been introduced by the French into the island of Martinique in 1717. From these plants it is generally believed to have been introduced into the American Continent, where it is extensively cultivated throughout the warm parts, also in Ceylon and other parts of India. The chief supply to this country comes from the West Indies,

Guiana, Brazil, and from eastern countries. In Sumatra the leaves are extensively used as an infusion like tea; and some years ago a patent was taken out for that purpose, but the project did not succeed. In its wild state it grows naturally in rocky places; and in Bermuda has become naturalized on the basaltic rock.

Peruvian, or Jesuits' bark (*Cinchona officinalis*, *C. calisaya*, *C. succirubra*, *C. micrantha*, and *C. nitida*). These, with several other species, yield Peruvian bark, from which the celebrated fever medicine, quinine, is obtained. They are all natives of the Andean regions of Peru, Bolivia, and New Granada, and are small branching trees not exceeding 40 to 50 feet in height, having simple opposite leaves; some not unlike coffee. The importance of the bark of these trees for the cure of fever was long known to the Indians; and the Countess de Chinchon, Lady of the Viceroy of Peru, having been cured of fever by it, Linnæus named the genus *Cinchona*, in honour of her. The curative value of Peruvian bark became known in Europe about 1640; and in time bark and port wine became a favourite medicinal prescription, which ultimately gave way to the pure extract of the bark,—an alkaloid called quinine. The demand for the bark being so great, it was feared the trees in their native countries would become extinct, as the different Governments took no steps to prevent their reckless destruction, or to make new plantations; but the great quantity of quinine required for India induced the Indian Government to attempt the introduction of the plant; and through the practical exertions of Messrs. Markham, Spruce, and Cross, in the year 1861, plants and seeds were successfully conveyed from Peru to Ootacamund in the Neilgherry hills, and placed under the care of Mr. McIvor, Superintendent of the Botanic Gardens there, where they flourished, and have been extensively propagated, so that large plantations have been formed under the auspices of the Government, as well as by private individuals. It is also successfully cultivated in Ceylon; plantations have also been established at Dar-

jeeling, and the Dutch have introduced it into Java. It is now under cultivation in Jamaica and Trinidad; and the late severe fever in the Mauritius has induced the authorities to introduce it into that island.

The Neilgherry plantations have already yielded bark in sufficient quantity to be brought to the European market, which has been found equally rich in quinine as that of Peru. It has also been found that an infusion of the leaves is useful in fever. The introduction and cultivation of quinine-producing plants in these countries is worthy of being recorded as an event of the highest importance to mankind.

The barks of many other plants of the family possess bitter and tonic qualities similar to quinine, but in an inferior degree, and are used in their native countries.*

Ipecacuanha (*Cephaelis Ipecacuanha*). A small mean-looking plant, native of Brazil, with a soft shrublet stem, about a foot in height, rising from a creeping knotty root; oblong blunt leaves about 1 or $1\frac{1}{2}$ inch in length, and heads of small, inconspicuous flowers. It grows in forests throughout the whole of Brazil, but like the Cinchona is, from the great demand for it, becoming extirpated in many parts. The roots of this plant have been long famed in medicine as a safe emetic, and as it is of great service in dysentery, as well as being tonic, it is considered a valuable drug, and attempts are now being made to introduce it into the West Indian Islands, as also into Ceylon, whither plants of it have been sent from Kew. The nature of the plant, however, seems to indicate that it would grow better in a wild state than under cultivation, as it will take a long time to establish it in quantity.

An inferior kind of Ipecacuanha, called "Striated Ipeca-

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* Mr. Cross, a gardener, has been despatched three times to the Cinchona regions of New Granada for plants and seeds; and four cases of *Cinchona Pitayo*, a species found to be very rich in quinine, are now (October, 1870) on their way to India.

cuanha," is produced by *Psychotria emetica*, a small tree or shrub, native of Peru; with inconspicuous flowers.

Gambier (*Nauclea Gambir*). A native of the Malayan Islands: it is a slender-growing shrub, climbing by the aid of abortive flower-stalks that become hard hooks. The leaves are oblong, about 2 or 3 inches in length. It is cultivated at Singapore, Sumatra, and other Malayan Islands, for the sake of its leaves, from which, by process of boiling, the substance called Gambier is obtained, and is used by the natives for chewing with the Betel-nut. It is also made into cakes, and large quantities are exported to China, as also to this country, for tanning and dyeing.

Dikamali resin is the produce of *Gardenia lucida*, a small stiff-branched tree with oval shining leaves, native of India. From the young shoots and buds a hard fragrant resin exudes, having something of the properties of myrrh, which is used for medicinal purposes, and, on account of its strong aroma, in hospitals in India for keeping away flies and other insects.

Considering the extent of this family there are but few that produce eatable fruits of any value, the chief being *Vangueria edulis*, a small stiff tree with large elliptical leaves, native of Mauritius; *Genipa americana* and *G. brasiliensis*, stiff-growing shrubs or small trees producing a fruit about the size of an orange. The native peach of Sierra Leone, *Sarcocephalus esculenta*, is a tree from 10 to 15 feet high, bearing a fleshy fruit the size of a peach.

The following are the principal of the family cultivated as ornamental plants in the hothouses of this country.

Cape Jasmine (*Gardenia radicans* and *G. florida*), natives of China, both well known for their double sweet-scented white flowers, which are in great request for wedding bouquets, as well as for wearing in head-dresses. It was long supposed to be a native of the Cape of Good Hope, hence the name Cape Jasmine. *G. longiflora*, *G. Stanleyana* and *G. Mallifera*, are small trees, natives of Sierra Leone, having large trumpet-shaped flowers 4 to 6 inches in length. *Port-*

landia grandiflora, native of Jamaica, has also similar flowers. *Ixora coccinea*, *I. fragrans*, and other species, are highly ornamental flowering shrubs, as also *Luculia gratissima* and *L. Pinceana*, natives of India.

The Woodbine Family.

(Caprifoliaceæ.)

Small trees or shrubs, often twining or trailing; rarely herbs. Leaves opposite (without stipules) entire, lobed or winged. Flowers in umbel-like tufts or corymbs, or spike-like panicles, some furnished with leafy bracts, rarely solitary, in the axis of the leaves. Corolla tubular, showy or inconspicuous, regular or irregular. Stamens 5. Fruit a dry, 1 or 2-celled capsule or a fleshy berry crowned with the persistent calyx.

About 230 species constitute this family. They are chiefly natives of the northern temperate hemisphere; few are found within the tropics. In New Zealand they are represented by several species of the fragrant genus *Alseuosmia*. Many of the species possess medicinal qualities, chiefly of a drastic and purgative nature.

Elder (*Sambucus nigra*). A well-known tree, native of this country, attaining the height of from 20 to 30 feet. Its wood is white and hard, and is used for making skewers and shoemakers pegs, also for turnery. Elder wine is made from its berries, which are also said to be used for colouring wine. The well-known eye-lotion "Elder flower-water," is made from the flowers. In Scotland it is called the "Boutry Tree," and is considered poisonous, where as well as in England a great deal of superstition is attached to it.

Woodbine, or Honeysuckle (*Lonicera Periclymenum*). A twining shrub, found wild in this country. It is a favourite for forming arbours, also for the sweet scent of its flowers. There are several species cultivated, which have been introduced from China and Japan, and are ornamental twiners.

Snowberry (*Symphoricarpus racemosus*). A native of North America, and cultivated in gardens as an ornamental shrub, its snow-white berries being conspicuous in the autumn.

Guelder Rose (*Viburnum Opulus*). A shrub, 6 to 10 feet high, native of this country. The flowers are produced in flat umbel-like corymbs, the outer series being abortive, and the petals enlarged and white; but in the cultivated variety the whole of the flowers are abortive and form the well-known "snowball flower."

Several other species of *Viburnum*, natives of North America, form ornamental shrubs; as also the Laurustinus (*V. Tinus*), a native of the South of Europe, which has long been cultivated in this country as a handsome showy flowering evergreen shrub.

The Mistletoe Family.

(Loranthaceæ.)

Shrubby parasites, rarely trees. Leaves opposite or alternate, thick, coriaceous, without apparent veins. Flowers axillary or terminal in umbel-like heads. Some unisexual, calyx small or a disk only. Corolla, consisting of 4 to 8 petals, free or sometimes united, forming a tube, generally long and of showy colours, as in *Loranthus*, or inconspicuous, as in *Viscum*. Fruit, a fleshy drupe-like glutinous berry, crowned with a circular scar or rim, one-seeded, which is partly exserted.

There being apparently only one floral envelope, much difference of opinion exists among botanists as to whether it should be viewed as a calyx or corolla; on account of its being conspicuous and coloured, as in *Loranthus*, and seated on a disk, it is here considered as a corolla, the disk representing the place of the abortive calyx. Above 400 species are recorded of this remarkable family. They are principally tropical, but are represented by *Myzodendron*, in Terra del Fuego, and by Mistletoe and *Loranthus Europæus* in Europe. They abound chiefly in forest countries, where they are truly

parasites, growing on all kinds of trees, forming great masses, and ultimately destroying the parent tree. They possess no principle of special interest, but are highly ornamental plants, having fine coloured tubular flowers like "Honeysuckle," especially the genus *Loranthus*, which contains 300 species. The only exception to their parasitical character are *Nuytsia floribunda*, a native of South-West Australia, and *N. ligustrum* of New South Wales, bushy trees attaining the height of 20 to 30 feet. When in flower they are so brilliant that they have received the name of "Flame trees." *Loranthus europæus* is found in Germany, but this as well as the tropical species, on account of their parasitical habit, are not cultivated. A considerable number of species belonging to the genus *Viscum*, on account of their minute flowers and other characters, have by some botanists been formed into a distinct family under the name of *Viscaceæ*.

Mistletoe (*Viscum album*) is common in the southern parts of Europe, and in England is most abundant in the south and west, the trees in the apple orchards of Herefordshire and adjoining counties being loaded with it. It is less seen in the north, and does not extend to Scotland. It was said never to grow on the oak, but this is a mistake, as of late years there are many recorded instances.

Much has been written respecting the Mistletoe, both as regards its parasitical mode of growth and structure, as also in relation to its ancient fame. History tells us it was held sacred in the religious ceremonies of the Druids. The very general custom of placing twigs and branches of Mistletoe in our houses at Christmas is probably a relic of its pagan sanctity, though now retained merely as an emblem of social friendship and jovial custom that has long characterized that festive season. To supply this simple emblem, many waggon-loads of Mistletoe are required for London alone, and it appears that the home produce is not equal to the demand, it being extensively imported from Normandy. Its berries are said to be poisonous, instances of death to children having occurred from eating them; but this appears to be owing

more to their glutinous nature causing them to adhere to the coats of the stomach, than to any active poison.

The Madder Family.

(GALIACEÆ.)

Herbs with slender angular stems and whorled leaves. Flowers small, axillary or in spikes or small corymbs. Corolla generally 4 cleft. Stamens 4. Fruit binate, dry, rarely pulpy, consisting of two cells, each containing 1 seed.

About 300 species are enumerated in this family, of which one half belong to the genus *Galium*. They are in general weak-stemmed weedy plants, the greater portion being natives of the cool regions of the northern hemisphere, a few only of India, South America, and Australia. They are easily recognised by their angular stems and whorled leaves; and on account of their star-like appearance the family has by some botanists been named *Stellatæ*. A red dyeing property pervades the whole of them.

Madder (*Rubia tinctoria*). A strong-growing perennial, native of the South of Europe and Western Asia, and cultivated in many parts for its roots, which yield the important red dye called Madder, greatly used in calico printing. *R. cordifolia* forms the Madder of Bengal, and is imported under the name of Munjeeth.

The imports of Madder to this country in 1869 amounted to nearly 72,000 tons; to supply this demand many hundreds of acres of land and thousands of people are employed in its cultivation. It is now threatened with total extinction, a substance having been discovered in coal tar, called Anthracine, which possesses all the properties of Madder. Its general use depends only on whether it can be obtained cheaper than Madder.

Several other species of *Rubia* have like properties, and it is said the flesh of animals becomes red when fed on these plants.

In this country the family is well represented by the

different species of *Galium; G. verum* growing in meadows, and is conspicuous in having pale yellow flowers. It has been long known to have the power of curdling milk, and hence it bears the name of Cheese Rennet. The roots are of a bluish colour, and yield a dye equal to Madder, for which purpose it is extensively collected. *G. Aparine*, a common hedge plant, is, on account of its adhering to the clothes of passers-by, known by the name of Cleavers, Goose-grass, or Ladies' Bed Straw.

Woodruff (*Asperula odorata*). A perennial, native of this country, generally growing in shady places in woods. It is in great favour for the aromatic smell of its leaves, which it retains for a long period when closed from the air. It is put into wine, giving it a peculiar flavour, and is known under the name of "Mai-trank," meaning Woodruff Wine.

THE BELL-FLOWER, THISTLE, AND VALERIAN ALLIANCE.

The Bell-Flower Family.

(CAMPANULACEÆ.)

Frutlets or more generally herbs. Leaves alternate, simple, entire, rarely lobed. Flowers solitary or in compact heads, spikes, or panicles. Corolla regular, 5-toothed or lobed. Stamens 5. Fruit, a capsule opening in various ways, chiefly by pores or slits, generally crowned with the persistent withered calyx.

About 500 species are recorded of this family, the greater number being natives of the temperate zone of the northern hemisphere; abundant in Europe and Asia, but few in North America. A few of a shrubby character are found in Madeira, the Canaries, and Azores, and in South Africa they are represented by the still smaller frutlets, *Lightfootia*, *Roella*, and *Wahlenbergia*. The principle of this family consists of a milky juice of an acrid nature, their chief use being as ornamental garden plants.

Hare-bell (*Campanula rotundifolia*). A well-known native

plant, ornamenting banks, waysides, and grassy places, and poetically known as the Blue-bells of Scotland. *C. latifolia*, the blue and white flowered varieties are also handsome native species found in woods.

Rampion (*Campanula rapunculus*). A native of this country, but not very common; it grows freely under cultivation, and its white fleshy running roots are sometimes used (more especially on the Continent) either raw as a salad or cooked as a vegetable.

Dwarf Bell-flower (*Campanula pumila* and *C. pulla*). Two pretty species, natives of the Alps. They grow in tufts with flower stems, from 4 to 6 inches in height, bearing blue or white flowers, and are favourite window-plants.

Canterbury Bells (*Campanula medium*). A strong growing garden annual, native of Germany and Italy. It has been cultivated in this country for about two hundred and fifty years.

Pyramidal Bell-flower (*Campanula pyramidalis*). A native of Austria, and has long been cultivated for its handsome appearance; its flower-stem attains the height of 3 to 4 feet; it is much used as a decorative plant, and is a favourite in cottage gardens.

Campanula Vidalii. A native of the Azores. It is a soft shrub species, producing erect flower-stems 2 feet high, bearing pretty white enamel-like flowers, and is, as well as the two following, a greenhouse plant.

Campanula (*Musschia*) *aurea*. A shrubby species, native of Madeira. It attains the height of 3 or 4 feet, and has broad tobacco-like leaves. It differs from the rest of the family in having yellow flowers deeply 5-cleft, which has led to its being characterized as a distinct genus.

Canarina Campanula. A native of the Canary Islands, but has been long introduced into this country. It is an interesting plant, having fleshy roots of great endurance, a plant at Kew having withstood all changes for more than fifty years, producing annually succulent stems, about 3 feet high, bearing pretty bell-shaped flowers of a rusty colour.

The Lobelia Family.

(Lobeliaceæ.)

Fruticuls, frutlets or herbs, with alternate, simple, or variously lobed leaves. Flowers solitary axillary, or in terminal spikes or racemes. Corolla irregular, sometimes tubular and often curved; 5-lobed; when deeply so, 2-lipped. Stamens 5. Anthers long, united edge to edge, forming a column round the pistil which is simple, with its apex cup-shaped or fringed with hairs. Fruit a 1 or more celled capsule opening at the apex. Seeds numerous.

Nearly 400 species are enumerated as belonging to this family; they are widely distributed within the temperate and tropical regions of both hemispheres; two are natives of Britain, and a few are found in North America. The whole of the family contains a strong-scented milky juice, extremely acrid, and poisonous. They are even dangerous to handle, as the juice coming in contact with the eyes causes temporary blindness. *Isotoma longiflora*, a native of the West Indies, is a very poisonous plant, so much so that it is even said to kill horses. Several are, however, under proper prescription, powerful and useful medicines; such are *Lobelia inflata* and *L. syphilitica*, natives of North America. *L. urens*, a native of this country, is a dangerous blistering plant. Many are highly ornamental and are much cultivated both under glass and in the open air; as *L. cardinalis*, a native of the Southern United States, and *L. splendens*, of Mexico, of which there are several various coloured intermediate varieties; while the small shrublet *L. Erinus* has come into repute as a flower-garden plant.

In alliance with *Lobeliaceæ* is the family of *Goodeniaceæ*, which differs in some technical characters of the flower, chiefly in the stamens being free, and in the whole being entirely destitute of the milk and poisonous qualities. There are about 150 species, chiefly soft shrubs or herbs, which are with few exceptions natives of Australia; they have no par-

ticular uses medicinally or economically, except *Scævola Taccada*, a curious soft frutical with broad obovate, somewhat sheathing leaves. It is common on the shores of Australia and Islands of the Southern and Indian oceans. It has large soft and spongy pith similar to that of the rice-paper plant, which is used for making curiosities. *Goodenia ovata* and *G. grandiflora*, as well as several species of *Leschenaultia*, have long been cultivated in the greenhouses of this country.

Another close alliance is the family of *Stylidiaceæ*, consisting of about 100 species, natives chiefly of Australia and New Zealand; they differ from *Goodeniaceæ* in many of them having grassy leaves, but more essentially in having only 2 stamens which are united to the pistil. In *Stylidium* the pistil is bent to near a right angle, and on being touched springs with an elastic jerk and thus discharges the pollen. *Stylidium graminifolium*, *S. adnatum*, *S. fruticosum* and others, have long been cultivated in greenhouses.

The Valerian Family.

(VALERIANACEÆ.)

Herbs, perennial or annual. Leaves entire or variously lobed, some almost winged. Flower-stems oppositely branched, bearing the flowers in spikes or panicles in the axis of the leaves, or terminal. Calyx membranous or feathery. Corolla regular or irregular, sometimes spurred. Stamens free. Fruit a dry achenia with 1 seed.

About 180 species constitute this family; they are widely distributed, chiefly in temperate regions. Most of them have a strong aromatic scent, which is not agreeable to many people. They are considered as stimulants, and are used for various purposes in medicine.

Lambs Lettuce or Corn Salad (*Valeriana olitoria*). A soft weedy plant, growing freely in loose soils in this country, and sometimes used as a salad, but more so in France, where three sorts are cultivated for that purpose; it is also used as spinach.

Valerian (*Valeriana officinalis* and *V. dioica*). These are natives of Britain, the first being a tall plant 2 to 3 feet high, growing in damp places. The other a more dwarfish plant, and differing from the rest of the genus in having stamens and pistils in separate flowers. The roots are extensively collected for medicinal purposes; they have a strong, disagreeable smell. It possesses antispasmodic virtues. Cats are extremely fond of the odour, plants in suburban gardens being often completely destroyed by their rolling on them; they even roll on the earth, before the plant appears above the ground. Rats are also fond of the smell, and the roots are used by rat-catchers to draw them together. The leaves are considered an effectual remedy for cuts and wounds and have received the name of "All-heal."

Spikenard (*Nardostachys Jatamansi*). A native of Western India and other parts. In some respects it resembles *Valeriana officinalis*, but the roots have a more powerful musky odour.

Much evidence has been brought forward to prove that this plant is the Spikenard of the Bible,* which is now generally admitted to be correct. It is extensively used by the ladies of Nepal and other parts of India to perfume oil for their hair, and is fully believed to be the Spikenard used by the ladies of ancient Rome, who, on account of the strong odour, must have had a different taste from the ladies of modern Europe.

The Teazel Family.

(DIPSACEÆ.)

Herbs or frutlets, with opposite, entire, or variously lobed, even, nearly winged leaves. Flowers in heads consisting of numerous florets, separated by straight or hooked calyx-like scales, seated on a common receptacle, surrounded by a leafy involucre. Corolla seated on the membranous or pappus-

* Song of Solomon, chap. i. ver. 12; chap. iv. vers. 13, 14.

like calyx; stamens 4, free. Fruit a dry 1-seeded achenia, crowned with the permanent calyx.

About 150 species constitute this family. They are chiefly natives of Europe, North Africa, and countries bordering on the Mediterranean; a few are found in South Africa. They have no special medicinal qualities.

Teazel (*Dipsacus sylvestris* and *D. Fullonum*). Biennial plants, native of this country. Their flower-stems attain the height of 4 to 6 feet, having large, opposite, lanceolate leaves, with their broad bases united, forming a reservoir which holds water. The flowers are in heads, terminal on branches, and are of a cylindrical form, 2 to 4 inches in length, and about 1 inch in diameter. When ripe the scales become hardened, having a stiff point, which in *D. sylvestris* is straight, but in *D. Fullonum* is bent at right angles like a hook, and forms the valuable article called Fuller's Teazel, no mechanical contrivance yet having been invented to supersede its use in dressing cloth; for which purpose it is cultivated in Yorkshire and many parts of Europe, and large quantities are imported from Germany and other parts of the Continent.

The genus *Scabiosa* contains many ornamental species which are grown in gardens. *S. atropurpurea* is an old favourite annual, generally known by the name of Mournful Widow. Three species are natives of this country, *S. succisa*, Devil's Bit, is a handsome field and wayside plant, attaining the height of 2 or more feet, having pretty heads of light blue flowers. *S. arvensis* is a well-known troublesome cornfield weed.

In alliance with *Dipsaceæ* is a small family, *Calyceraceæ*, consisting of about 20 species of herbs, natives of various parts of America. They hold an intermediate position between *Dipsaceæ* and *Compositæ*, differing from the first by the anthers being united, and from the latter in the nature of their seeds. They are of no known use.

The Thistle Family.

(Compositæ.)

Herbs, frutlets, or shrubs, rarely trees, with alternate, simple, entire, or variously divided leaves; often heath-like, or large and of rounded form 1 foot or more in diameter. Flowers in heads consisting of numerous florets seated on a common receptacle, surrounded by an entire or many-scaled involucre, corolla tubular, equal, or the exterior side of the limb of the tube extended in the form of a petal-like lobe or strap, termed ligulate or bilabiate; florets unisexual, bisexual, or neuter. Stamens 5, the anthers united, forming a cylinder round the pistil which is simple, with a bifid apex. Fruit a dry 1-seeded achenia, crowned with the permanent scariose or plumose feathery calyx.

The whole of the plants of this family are included in the 19th Class, Syngenesia of Linnæus (see page 81).

In natural arrangement this extensive family is divided into 3 sub-families.

1st. *Liguliflorœ*, in which the florets are all ligulate, and correspond with part of the first order, *Æqualis*, of Linnæus, and are characterized by being furnished with a milky juice.

2nd. *Tubuliflorœ*. In this the florets are in the form of a tube, straight or curved, 4 or 5 dented, or more deeply cleft and bisexual, often with pistil bearing or barren ligulate rays.

3rd. *Labiatiflorœ*. In this the florets are bilabiate; that is, 2-lipped.

This, the largest family of plants, consists of between 9000 and 10,000 species, and may, therefore, be considered as forming about one-tenth part of the whole vegetable kingdom. They are found in all parts of the world where plants can grow, but it is remarkable that but few of them assume the character of trees. A considerable number are small shrubs, but the greater mass are herbaceous perennials and

annuals of most free and ready growth, forming great pests in cornfields and gardens. Some are of high aromatic odour, and tonic, bitter, and astringent; but few possess poisonous qualities. Many have medicinal virtues ascribed to them in their native countries for the cure of wounds and snake-bites. Many are used for food, and others produce substances useful in the arts, of which the most important will be noticed.

Jerusalem Artichoke (*Helianthus tuberosus*). This is said to be a native of Brazil; it is a tuberous-rooted plant, with rod-like stems, rising to the height of from 5 to 7 feet, having large alternate entire leaves. It was introduced to this country two hundred and fifty years ago; and, before potatoes were known, its tubers were much used as a common article of diet for the poorer classes. They are highly nutritious, and are extensively used in France, but not now much cultivated in this country. This has nothing to do with the true Artichoke, neither does it come from Jerusalem, the name being only a misapplication of the Italian word *girasole*, and the flavour of the root being something like Artichokes.

Sun Flower (*Helianthus annuus*). A well-known annual, said to be native of Mexico and Peru, introduced about the end of the sixteenth century; under cultivation it produces flowers a foot or more in diameter. It is a plant of great utility, and is extensively cultivated in this and other countries for its seeds, which are highly valued for feeding sheep, pigs, poultry, pigeons, rabbits, &c., and is considered superior to linseed for cattle. An oil is expressed from the seeds, and is used in Russia in cookery; it is said to have the flavour of olive oil. They are also ground up into a meal, the finer kind being made into tea-cakes; and in some parts they are roasted and used in the place of coffee. It is an excellent plant for bees, large quantities of honey and wax being obtained from the flowers. The Chinese grow it very extensively, and it is believed that a large portion of its fibre is mixed with their silks.

Chicory, or Succory (*Cichorium Intybus*). A hardy peren-

nial, native of Britain, growing by roadsides and in waste places, particularly in calcareous soils. It has a thick tap root like a carrot, and produces branching stems, 2 to 3 feet high, bearing pretty blue flowers. It is cultivated as a salad-plant, the young leaves being blanched like endive, and in this way is largely used in France; but its chief importance is from its root, which has come into repute for mixing with coffee for the purpose of imparting an agreeable flavour; it has slightly diuretic qualities. It is extensively cultivated for this purpose, both in this country and on the continent, from which latter place the best quality is imported.

Endive (*Cichorium endivia*). Said to be a native of the East Indies or China. It was introduced about three hundred years ago; it is in general cultivation as a winter salad plant. There are several different varieties, the principal being the broad-leaved and curled.

Lettuce (*Lactuca sativa*). The native country of the garden Lettuce is unknown, but it is generally supposed to be Asia. It has been cultivated in this country for about three hundred years. There are several varieties, of which the summer or Cos Lettuce is the best known, and is supposed to have come from the island of Cos (now modern Stencho), whence its name. Their properties are narcotic; the milky juice, which abounds greatly in the wild species, *L. virosa*, a native of this country, resembles opium in its properties. An extract has of late years been prepared from *L. sativa*, which is used medicinally, and is milder and not attended with such depressing effects as opium.

Dandelion (*Leontodon taraxacum*). This well-known plant is a native throughout Europe, Northern Asia, and Africa, and possesses great powers of reproduction by its roots, as also by its numerous seeds being wafted by the wind to new localities, where they grow readily, especially in fields and waste places. It takes its name from the French *dent*, a tooth, and *leon*, a lion, the gashes of the leaf resembling large teeth like lion's teeth. The roots are extensively used in medicine, being tonic and powerfully diuretic; it is also used

for flavouring coffee, being similar to chicory. Its young blanched leaves are used as salad.

Scorzonera (*Scorzonera hispanica*). A perennial, native of Spain. Salsafy (*Tragopogon porrifolius*). A biennial, native of this country. These are both cultivated in gardens for the sake of their roots, those of the former being like a carrot, but black outside, white inside; those of the latter not so large. They are used in various ways.

Artichoke (*Cynara scolymus*). A native of the countries of the Mediterranean, and known in this country for at least three hundred years. It is a hardy perennial, with large gashed leaves, 2 or 3 feet long, of a greyish colour, and is cultivated for its flower-heads, which are composed of large scales, the base being thick and called Artichoke bottoms, the part used as a vegetable.

Cardoon (*Cynara cardunculus*). A native of the South of Europe. It has been known in this country for above two hundred years, and is allied to the preceding, but the part used as a vegetable is the blanched leaf-stalks. Its flowering head is smaller than the Artichoke, and is crowned with pretty blue flowers that are said to curdle milk.

Camomile (*Anthemis nobilis*). A hardy perennial or rather evergreen shrublet with fine cut leaves, native of Britain. There are two varieties, one with single and the other with double flowers. They are greatly used as a tonic, being extremely bitter, also as emetic, and in fomentations. The plant is extensively grown at Mitcham in Surrey, and in Derbyshire. The double sort is generally sold in chemists' and druggists' shops, whereas the single is purchased and sold exclusively at Apothecary's Hall. An oil is extracted from the entire plant, one variety yielding a blue and the other a green oil.

Flea powder (*Pyrethrum carneum*, *P. roseum* and *P. purpureum*). Natives of Caucasus. They are perennial plants with much divided leaves, and probably forming only one species, varying in the colour of their flowers, as indicated by their names. A preparation was at one time made from the

leaves, and extensively used throughout Russia for the destruction, or rather driving away of fleas and other vermin of like nature. About forty years ago it became very popular, and still continues to be used in Germany.

Feverfew (*Pyrethrum Parthenium*). An erect bushy plant, a foot or more in height, with much divided leaves, the whole of a light green colour, having white rayed flowers like Camomile. It is wild in many parts of this country, often growing on walls, but considered a doubtful native. It is bitter and tonic, and is an old remedy in fevers. The smell is strong and offensive, and is sometimes used to drive bees from their hives. A double variety of it is grown as an ornamental garden-plant.

Pellitory of Spain (*Anacyclus Pyrethrum*). A perennial, native of the south of Europe, having much divided leaves and prostrate stems, with white flowers. It is cultivated in the south of Europe and north of Africa for its roots, which are cut in short pieces, known in the shops under the name of "Radix Pyrethri," and used medicinally and for tooth-ache. It first causes a sensation of cold, followed by heat.

Elecampane (*Inula Helenium*). A strong growing perennial with large entire leaves, and flower stem 3 or 4 feet high, bearing large yellow-rayed flowers. It is native of this country, and is cultivated for its roots; the whole plant has an aromatic bitter flavour, especially the root, which abounds in a mucilaginous principle resembling starch. It has been famed as a medicinal plant of great virtue, but is now out of repute, and is only used for flavouring sweets.

Colts-foot (*Tussilago Farfara*). A perennial, common in roadsides and waste places, often seen abundant in railway cuttings. It has large angular-shaped leaves of a greyish colour. It is bitter and astringent, containing a large quantity of mucilage, and much used in cases of asthma, being smoked like tobacco.

Tarragon (*Artemisia Dracunculus*). A hardy perennial, native of Siberia, and cultivated in gardens as a culinary

herb. It is used in salads and soups, also pickled, and an infusion in vinegar forms tarragon vinegar.

Wormwood (*Artemisia Absinthium*,) *A. maritima*, natives of Britain, and *A. pontica* of Germany, east of Europe, and western Asia, are all hardy perennials, having the same habit and properties, being aromatic, intensely bitter, and in great repute as a vermifuge, whence its name Wormwood.

It is used to prevent moths and other insects from infesting clothes and furniture. In Switzerland a bitter abstract called Absinthe is extensively manufactured from these, especially *A. pontica*, and is drunk in large quantities by the French, millions of gallons being annually imported from Switzerland, as well as a large quantity of it being manufactured in France. It first produces activity and pleasant sensations, and inspires grand ideas to the mind, but its habitual use brings on stupor and gradual diminution of the intellectual faculties, ending in delirium and death. The French Government have found it necessary to prohibit the use of it in the army and navy. Wormwood is frequently mentioned in the Bible, and is symbolical of bitter calamity.

Southernwood (*Artemisia Abrotanum*). A well-known garden shrub, much in favour for its stimulating, aromatic odour; it is native of the south of Europe. In some parts of Scotland it is known by the name of "Apple ringey."

Moxa (*Artemisia chinensis*). A native of China, and used for producing a blister, which is done by burning small pellets of the dried plant on the skin.

Costus (*Aplotaxis Lappa* or *Aucklandia Costus*). A strong rooted perennial, native of the valleys of Cashmere, producing a flower-stem 5 or 6 feet in height; lobed slashed leaves about 2 feet long, and flowers in thistle-like heads, of a purple colour; the root is collected in large quantities and conveyed to Bombay, where it is shipped to ports in the Persian Gulf, the Red Sea, and to China. Its chief use is for incense and perfume, also to protect Cashmere shawls from moths. It is supposed to be the celebrated *Costus* of the ancients.

Guaco (*Mikania guaco*). This and several other species of

Mikania are climbing plants, with opposite, generally sessile leaves. They are common throughout tropical America, and several of them are in high repute for the cure of snake bites, more especially *M. guaco;* but its powers are not well authenticated, and the name *Guaco* is applied to other climbing plants, such as *Aristolochia*, which are also used for the same purposes.

Madia Oil (*Madia sativa*). A clammy annual, native of Chili, and cultivated in many parts of America and Europe, for the sake of its seeds, which are made into oil-cake.

Safflower (*Carthamus tinctorius*). A prickly stiff-leaved annual, about 2 feet high, producing spiny heads of red flowers. It has long been cultivated throughout China, India, the Levant, Egypt, Southern Europe, and even at one time in England, where it was introduced three hundred years ago. It yields a valuable dye, varying in shades of colour between red and yellow, which is obtained by collecting the red florets of the flower just before withering, and is greatly used for dyeing China silks, crapes, and Spanish wool. It is also the principal ingredient in the rouge that is used by theatrical actors, &c. The chief import comes to this country from China, India, and Egypt. The seeds yield an oil, which in India is used for burning in lamps as well as for culinary purposes.

The principal shrubby and woody species of this family are found within or near the tropics; they also abound in South Africa, Australia, Tasmania, and New Zealand. But few assume the character of timber trees, the principal being—

Musk Tree (*Aster* (*Eurybia*) *argophylla*). A native of Tasmania, and one of the largest trees of the family; it attains the height of 20 or more feet with a diameter of 1 foot, furnishing a hard, solid wood that takes a good polish. It has lance-shape silvery leaves, 3 to 5 inches in length, smelling strong of musk, and on that account is an old favourite in the greenhouses of this country.

Bedfordia salicina. Another tree of Tasmania, but smaller

than the last, seldom exceeding 15 feet in height, often more like a shrub. The wood is prized for its beautiful grain, and is used for cabinet work, under the name of Dogwood.

In New Zealand, *Eurybia furfuracea*, and several others, are hard wooded and attain the size of small trees; as also *Senecio Forsteri*, which is remarkable for its large white repand leaves.

African Fleabane (*Tarchonanthus camphoratus*). A native of the Cape of Good Hope. It is a large shrub, often assuming the appearance of a small tree 10 to 15 feet high, having elliptical greyish leaves, smelling strongly of camphor, on which account it is supposed to be a remedy against fleas. It has been introduced to this country about one hundred and sixty years, and is often to be seen in greenhouses. It may be considered the largest and most woody representative of the family in South Africa.

In America the woody kinds are represented by different species of *Baccharis*, and in Brazil by *Stifftia Chrysantha*. A small tree, about 10 feet in height, having much branching stems, lanceolate, shining leaves, and bearing heads of orange-coloured flowers. It belongs to the division *Labiatiflorœ*, and has long been cultivated in the hothouses at Kew.

Amongst the curious plants of the family is *Ceradia furcata*, a native of dry barren places on the South-West Coast of Africa. It is a soft, thick, erect, branching shrub, the branches forking like horns; the whole being about a foot or more in height, having a few simple leaves on the top of each shoot, and with flowers not unlike the common groundsel. A fragrant gum exudes from the fractured stems.

The species of the genus *Klenia* are also succulent, often jointed-stemmed, and sometimes leafless; *K. articulata* being frequently grown in windows as a curiosity, and known by the name of the Candle plant.

There are many ornamental garden plants belonging to this family, of which only a few can be here noticed, as—

Chrysanthemum indicum, a native of China. Its date of

introduction is not recorded, but is known to have been cultivated about one hundred years ago, first being treated as a greenhouse plant; but as it was found to flower in the open air in autumn, it soon became a great favourite. Other fine varieties have been introduced, as also raised in this country, and Chrysanthemum shows now yearly take place.

The *Dahlia* may be considered the next in repute. It is a native of Mexico, and is recorded as being introduced in 1789 and 1802. It was supposed there were two species, *D. superflua* and *D. frustranea*, but they are now considered to be one. The flowers were originally single, one having pistilliferous rays, and the other barren; the two now are united under the name *D. variabilis*. The first plants introduced do not appear to have been much valued and were early lost; but it was again introduced from France, and about 1818 began to be specially noticed in this country, the roots being considered eatable like the potato, but it found no favour. About 1820, seedling plants began to produce double flowers, which florists have now brought to the highest state of perfection. One of the most ornamental spring-flowers of the greenhouse is the well-known *Cineraria*, of which there are many beautiful varieties, varying in shades of colour of white, blue, red, &c., the original species being *C. cruenta*, a native of Teneriffe.

Thistles consist of about 200 species of prickly, biennial, or perennial plants, belonging chiefly to the genus *Carduus*, *Cnicus*, and *Onopordon*, of which 14 or 15 are natives of this country, *Cnicus arvensis*, and *C. lanceolatus*, being well-known cornfield and meadow pests. *Carduus Marianus* is known as the Blessed, Milk, and Mary's Thistle, superstition ascribing the white lines or marks on its leaves to a drop of the Virgin Mary's milk having fallen on it. *Onopordon Acanthium*, native of the south of Europe, has become indigenous in this country, but rare; generally found growing in gardens. It sometimes attains the height of from 6 to 8 feet, and has numerous hoary branches, each termi-

nated by a head of pink flowers, the whole having the appearance of a magnificent candelabrum.

In heraldry the figure of a thistlehead in flower constitutes the badge emblematic of Scotland. It appears to have first come into use in 1488; but in early history no cause is assigned for its being chosen, all legends, and what has been written about it in modern times, being merely fables. In 1540 James V. instituted an order of knighthood called the Order of the Thistle.

Thistles were in early times known as only natives of the temperate Northern hemisphere, but they have now extended their domain to the South. In some countries, such as the grassy plains of South America, extensive tracts are now occupied by them. They have also spread widely in South Africa, Australia, New Zealand, and other countries. They are truly usurpers and conquerors of the soil, and as such are favoured by nature, their pappus seeds being carried in the air to great distances; and well may it be said of them —"See the conquering hero comes!" for on whatever soil they fall that is at all favourable to plant-life, a colony of thistles appears, the original holders of the soil disappearing before them. They are, however, wholesome; and, after being bruised to destroy the prickles, are given as food to cattle. In New South Wales the Milk Thistle becomes useful in dry seasons for cattle food.

Several other species of the family may also well be called usurpers, such as the Common Daisy (*Bellis perennis*), Groundsel (*Senecio vulgaris*), Dandelion (*Leontodon taraxacum*), Cat's-ear (*Hypochœris radicata*), &c., these being pests in lawns and pastures.

SECTION 2.—POLYPETALÆ.

Ovary inferior.

Stamens usually perigynous, or sometimes on an epigynous disk.

THE UMBEL, IVY, AND DOGWOOD ALLIANCE.

The Umbel Family.

(UMBELLIFERÆ.)

Herbs, generally with hollow flower-stems, or rarely permanent shrubby, branching, or single tree-like stems, having alternate leaves, generally lobed, and much divided into numerous segments, sheathing at the base. Flowers in umbels, generally furnished with universal and partial involucræ. Petals 5, seated on an epigynous disk. Fruit consisting of 2 one-seeded flat carpels united by a common axis, separating when mature; they are traversed by ridges called vittæ, containing oil.

An extensive family, containing more than 1500 species, chiefly natives of temperate countries of the Northern hemisphere and elevated regions within the Tropics; they are represented in the Southern hemisphere in the form of shrubs. The only tree representatives are *Monizia edulis* and *Melanoselinum decurrens*, natives of Madeira. Three distinct properties pervade the family—viz., acrid and poisonous, aromatic and wholesome, or milky and resinous.

Carrot (*Daucus Carota*). A biennial, native of Britain; in its wild state it is found by roadsides and in waste places. It has a dry, slender root, which is not edible; but it is generally believed that the cultivated garden carrot originated from it. The carrot was known to the Romans, and is supposed to have been introduced to this country from Holland about three hundred years ago. The juice is used for colouring cheese.

Parsnip (*Pastinaca sativa*). A native of Britain, found growing in waste places; like the carrot, it is inedible in

its wild state. The cultivated parsnip was, according to Pliny, cultivated in Germany, from whence it was originally brought to Rome. In this country it, as well as the carrot, forms a useful winter vegetable. It is extensively cultivated in Jersey, and pigs fed on it make excellent pork; it contains sugar, and a wine is made from it called parsnip wine.

Celery (*Apium graveolens*). A biennial, native of various parts of England, and throughout Europe, also widely dispersed over the temperate regions of the Southern hemisphere. In its wild state it is to a certain degree poisonous, but under cultivation becomes a wholesome salad and pot-herb.

Parsley (*Apium Petroselinum*). A biennial, originally believed to be a native of Sardinia. It has become wild in some parts of England, and is cultivated as a well-known pot-herb.

Caraway (*Carum Carui*). A biennial, native of Europe, and has become wild in some parts of Britain. It is cultivated in Essex and Kent for the sake of its seeds, which are carminative, and used in confectionery, as well as for flavouring spirits, and perfuming soaps. An oil is also obtained from it which is used medicinally.

Coriander (*Coriandrum sativum*). An annual, native of the South of Europe, and, like the caraway, is cultivated in this country for the sake of its aromatic seeds, which are used in confectionery, and also for flavouring spirits. The so-called seeds of caraway and coriander are, in reality, true fruits.

Dill (*Anethum graveolens*). A biennial, native of Spain, and other parts of Europe. It somewhat resembles fennel, and is cultivated for the sake of its seeds, from which, by distillation, dill-water is obtained. They are also used as a condiment, and contain an essential and ethereal oil used in medicine. The leaves of the plant are used for flavouring soups and pickles. This is supposed to be the Anise of the New Testament.

Cummin (*Cuminum sativum*). An annual, with fennel-like leaves, and seeds like the caraway, having an aromatic but somewhat bitter flavour. It appears to have been early

cultivated in Palestine, as it is mentioned in Isaiah,* as well as in the New Testament.†

Aniseed (*Pimpinella Anisum*). An annual, native of Egypt. It is cultivated in the Levant and Spain for the seeds, which are used in confectionery, and a well-known cordial, called Aniseed, is made from them.

Angelica (*Angelica Archangelica*). A tall growing plant, with broad parsnip-like leaves, native of this country. Candied Angelica is made from the leafstalks; and the root was at one time famed for yielding an aromatic tincture.

Fennel (*Fœniculum vulgare*). A perennial, aromatic plant, naturalized in this country, and wild in Europe and some parts of Asia. It is a tall plant, the flower stems in summer rising to the height of five or six feet, and is cultivated in gardens for its finely cut leaves, which are much used for garnishing and flavouring fish sauce. Fennel oil is extracted from its seeds.

Finochis or Finicho (*Fœniculum dulce*). This is considered by many to be a variety of the preceding, but differs from it in the base of the radical leafstalk being swollen, thick, and becoming united, thus forming a kind of tuber, which is used extensively in France and Italy as a culinary vegetable. It is not much cultivated in this country, but is sometimes to be seen in the vegetable markets in London.

Chervil (*Scandix Cerefolium*). A native of Europe, and has become wild in some parts of England, where it has been cultivated as an aromatic pot-herb for more than two centuries.

Skirret (*Sium Sisarum*). A perennial, native of China and Japan. The roots are the part used, and are about the thickness of a finger. It was at one time much cultivated as an esculent vegetable, but is now seldom seen.

Samphire (*Crithmum maritimum*). A perennial, native of the rocky shores of Europe, abundant on the Cliffs of Dover. It is collected and made into a pickle.

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* Chap. xxviii. 25, 27. † St. Matt. xxiii. 23.

Sea Holly or Sea Holm (*Eryngium maritimum*). A strong growing perennial, found on the sandy shores of this country. It has spiny leaves, and compact heads of blue flowers, the whole plant having a bluish-white appearance; the roots are candied and sold as candied Eryngo. When boiled or roasted, they resemble chestnuts, and are palatable and nutritious.

Arracacha esculenta. A native of and cultivated in abundance in the Andean regions of Peru and New Grenada. It is similar in growth to some species of *Chærophyllum*, and has large fusiform roots like carrots, forming an extensive article of food to the inhabitants of the above-named regions. About forty years ago it was introduced into this country under the expectation that it would supersede the Potato, but it did not succeed.

Giant Fennel (*Ferula communis*). A tall perennial, native of the South of Europe, often attaining the height of 10 or more feet, having stems about 3 inches in diameter filled with pith which, when dry, ignites like tinder, and is used in Sicily and other parts for that purpose. When once ignited it consumes very slowly, and without injury to the tube of the stem: it is used for preserving and carrying fire from place to place. This custom is of great antiquity, and serves to explain the passage in Hesiod, where speaking of the fire Prometheus stole from Heaven, "He says he brought it in Ferula."

Asafœtida (*Ferula* (*Narthex*) *Asafœtida*). A tall growing plant with fennel-like leaves, from which it scarcely differs as a genus. It is a native of Thibet and the western parts of Asia, and is said to produce the genuine asafœtida, which is a milky juice that exudes from and hardens on the root when cut. In this country it is used in medicine, but has a most nauseous smell, hence the name "Devil's Dung," being a great contrast to the name, "Food of the Gods," given to it by the Persians, who hold it in high esteem, and use it as a condiment. Several other allied species also yield asafœtida of various qualities.

Ammoniacum (*Dorema ammoniacum*). A tall fennel-like plant, native of Persia, and other parts of Western Asia. It attains the height of six or seven feet, and has large compound leaves. The stem, when punctured, yields a milky juice, which hardens and becomes Gum Ammoniacum. A similar gum is yielded by other allied species. The punctures are made naturally by insects, which abound at the time the plant has attained perfection. It is used medicinally in this country as a stimulant.

Silphium (*Ferula* (*Thapsia*) *Silphium*). This is supposed to have yielded the gum resin called "Laser Cyrenaicum," which was so highly valued by the people of ancient Cyrene that they thought it worthy of being represented on their coins. In order to its identification, the late Mr. Kœnig, keeper of the coins in the British Museum about thirty-five years ago, procured a plant direct from Cyrene, which was understood to be the "Silphium." Unfortunately it did not long survive the effects of its transit, but the few radical leaves it had on its arrival were sufficient to enable me to determine it to be closely allied, if not identical with *Ferula glauca*, a species with multifid glaucous leaves and a smooth stem attaining the height of from 4 to 5 feet, bearing showy umbels of pale yellow flowers. It is a native of the South of Europe, and is recorded as being introduced more than three hundred years ago.

Gum Galbanum, *Gum Opopanax*, *Gum Sagapenum*, and other similar gums, are obtained from plants allied to *Ferula*, but it is doubtful what species yield the different kinds.* They are natives of Syria, Persia, and countries bordering the Mediterranean. There are three kinds of *Galbanum*—viz., Galbanum in grains or tears, Galbanum in masses, and Persian Galbanum, all of which are obtained from exudations of the stem or root.

A gum of some of the above mentioned plants is supposed to be the substance spoken of in Exodus, chap. xxv. ver. 10,

* It is now ascertained that the first is obtained from *Ferula galbaniflua*, and the second from *Chironium opopanax*.

and other parts of the Bible, as being used for incense and perfumery.

Hemlock (*Conium maculatum*). A common plant in this country, growing in waste places, hedges, and roadsides. It has a hollow stem marked with reddish spots, rising sometimes to the height of 3 or 4 feet, bearing umbels of white flowers, and much divided parsley-like leaves; the whole of a pale green colour, having a nauseous smell when bruised. The plant is poisonous in the highest degree, the most active part being the fruit. In medicine it is called Conium, and is beneficial in some diseases when properly administered.

Water Dropwort (*Œnanthe crocata*). A strong growing perennial, attaining the height of 2 or 3 feet, having compound divided leaves, with broad segments. It grows in ditches and watery places, and has thick Parsnip-like roots, but differs from that plant in a number growing together; they are poisonous in the highest degree. Several years ago a number of convicts were poisoned through eating this root in mistake for Parsnips, and cattle have suffered by eating those cast out in clearing ditches.

Water Hemlock (*Phellandrium aquaticum*). Water Parsnip (*Sium latifolium*). *Cowbane* (*Cicuta virosa*). Natives of Britain, growing in wet places, even in water. They are all highly poisonous, fatal accidents having occurred by the leaves being eaten in mistake for Celery and Parsley. Indeed it may be said that all umbelliferous plants growing near watery places possess a more or less poisonous quality.

Fools Parsley (*Æthusa Cynapium*). An annual, native of this country, often growing in cultivated ground, and in gardens, so much resembling parsley, especially the broad-leaved kind, that it has been used for such. It is highly poisonous, producing numbness, insensibility, and sometimes death. It is distinguished from parsley by the bluish tint of its leaves, and being an annual, it comes into flower long before Parsley.

The whole of the preceding plants are of very uniform appearance and character, being herbaceous, annuals, and pe-

rennials, varying chiefly in size, and their leaves being more or less compoundly divided; the umbels of flowers being white or yellow. As already stated, few partake of the shrub or tree character, but the following may be mentioned as curious examples:—

Monizia edulis. A native of a small island contiguous to Madeira. It is one of the few single-stemmed tree representatives of the family. The stems of young plants look like carrots or parsnips growing above ground; but in old plants they attain a diameter of 6 inches at the base, tapering upwards, and attaining the height of from 4 to 6 feet, terminating with a crown of decompound spreading leaves, having the aspect of a tree fern. The roots are somewhat succulent, and are eaten.

Balsam Bog (*Bolax glebaria*). A heath-leaved shrub, having branches successively forking from a central root, being short and moss-like, and growing so compact that old plants become so firm and hard as to resist the pressure of the hand; they assume the shape of round hillocks, 3 or 4 feet in diameter, and the same in height. It is a native of the Falkland Islands, and the large number of them imparts a peculiar feature to the landscape. A gum is obtained from it, which is used in medicine. A specimen of this curious plant is to be seen in the Museum at Kew, measuring 9 feet 4 inches in circumference.

The only hardy shrubby species of the family is *Bupleurum fruticosum*, a much-branching small shrub, with roundish entire smooth leaves. Native of the South of Europe.

The greater number of shrubby species are found in Australia, consisting of species of the genera *Trachymene*, *Astrotricha*, *Xanthosia*, and others.

The Ivy Family.

(Araliaceæ.)

Small trees, soft-wooded shrubs, or climbing Ampelids, rarely herbs. Leaves alternate, entire, lobed, palmate, or

digitate; or once or twice winged, or more divided; the footstalk sheathing, sometimes with superior lobes like stipules. Flowers generally in umbels, panicles, or racemes, some unisexual. Petals and stamens varying from 2 to 10. Fruit dry, consisting of several cells, each containing 1 seed, or succulent, berry like.

Nearly 200 species constitute this family, which are widely distributed in both temperate and tropical regions, and in many respects are allied to *Umbelliferæ*, but differ in being, with few exceptions, all of a shrubby or arborescent habit.

Ivy (*Hedera Helix*). The common Ivy is a native of this country, and is well known by its covering walls and climbing over trees, to which it gives a picturesque appearance. In winter its berries constitute a great part of the food of birds. The specific name "*Helix*" was given to the Ivy by Linnæus, on account of it being a great harbour for snails —*Helix* being the scientific name of a shell like that of the snail. It is called the emblem of friendship, but its friendship with trees is to gradually choke and destroy them.

The ancients dedicated the Ivy to Bacchus, the God of Wine; and in the Book of Maccabees we read, that on the feast of that god being kept, "the Jews were compelled to go in procession to Bacchus, carrying Ivy."

Ginseng (*Panax Schinseng*). A native of Tartary and Northern China, growing at one time abundantly in Manchuria; but its great use in China has caused it to become scarce. It is a low herbaceous plant with forked roots, which the Chinese imagine resembles the human form, and is supposed to ward off all diseases. It is slightly bitter and aromatic, but is not of much repute with European doctors. *P. quinquefolia*, a native of North America, is sometimes substituted for it.

Rice-paper Plant (*Aralia papyrifera*). The plant producing the beautiful substance called Rice-paper, was long unknown to botanists, and on inquiry being made respecting it, fanciful figures and descriptions were given of it by the

Chinese. Not long after the commerce of China was opened to Europe it was ascertained that it came from the Island of Formosa, which led Sir John Bowring, then Governor of Hong-Kong, to obtain plants from that island, one of which arrived safely at Kew in 1853, and flowered in 1855; thus proving it to be an *Aralia*. It is a small tree, attaining the height of about 10 feet, with a stem from 3 to 4 inches in diameter, the interior being full of white pith like the Elder. It has soft, downy, palmate leaves, something like those of the Plane Tree, growing on long footstalks, and produces a somewhat erect panicled raceme of small flowers. The tree is cut down in order to obtain the pith, which averages, according to size, about 1 inch in diameter. It is divided into pieces about 3 inches in length, and by the aid of a sharp instrument is unrolled, forming a thin narrow sheet, and constitutes Rice Paper, which is greatly used by the Chinese for drawing figures of plants and animals, and also for making artificial flowers. The plant requires the protection of a greenhouse in this country; but in warm countries, such as New South Wales, it has already almost become indigenous.

The family is well represented in hothouses by several species of *Panax*, *Aralia*, *Sciadophyllum*, *Gilibertia*, *Gastonia*, and two Cape of Good Hope species of *Cussonia;* in the open air by the Angelica tree (*Aralia spinosa*), a native of North America; also the herbaceous species *A. nudicaulis*, and *A. racemosa*. In New Zealand it is represented by about 10 species, *Aralia polaris* being a bushy perennial 3 or 4 feet high; *A. crassifolia* is a slender pole-like tree, 20 or more feet in height, and is remarkable in having simple or trifoliate strap-like leaves, some a foot or more in length, and about $\frac{1}{2}$ an inch in width. In Australia, *Panax sambucifolia* forms a small tree or bushy shrub.

Botryodendron macrophyllum, a native of Norfolk Island, has also a slender pole-like stem, 10 to 15 feet high, having broad elliptical entire leaves, $1\frac{1}{2}$ to 2 feet in length, which a celebrated traveller compares to a loose cabbage fixed on a

broomstick. Specimens of these curious plants are to be seen at Kew.

A remarkable plant, *Gunnera scabra*, a native of Chili, is referred by some botanists to this family. In habit of growth it is similar to Rhubarb, having rough leaves, sometimes attaining a diameter of 6 feet; a plant at Kew measured 15 feet across. It may be considered the largest leaved herbaceous exogen.

The Dogwood Family.

(Cornaceæ.)

Small trees or shrubs, rarely herbs, leaves simple opposite (in one case alternate). Flowers in umbels (with or without petaloid involucrum), or in panicles or racemes, seldom solitary and axillary, rarely unisexual. Petals and stamens 4 each. Fruit a 2-seeded berried drupe, bearing the permanent calyx.

About 50 species are enumerated as belonging to this family. They are natives of the temperate regions of the Northern hemisphere, extending to the limits of plant life, and represented in New Zealand by the genus *Corokia*, a white lance-leaved shrub, with axillary small yellow flowers.

Cornelian or Jews Cherry (*Cornus mascula*). A native of many parts of Europe; in this country it is a small tree, or rather bushy shrub, attaining the height of 10 or 15 feet, its numerous small yellow flowers in spring making it conspicuous. The fruit is oblong, clear and shining, of a cornelian colour, and about the size of a small plum. It is not very palatable, but is eaten in some parts as a substitute for olives; it is also preserved and used in confectionery, and in Turkey for flavouring sherbet. It is considered useful in dysentery, and during the time of cholera in Constantinople was the only fruit allowed to be sold in the streets. Its wood is hard and durable, and is used for making many domestic implements.

Dogwood or Cornel Tree (*Cornus sanguinea*). A common shrub in this country and throughout Europe and North

Africa, well known by its pretty red wood and black berries. It takes its name of Dogwood from the circumstance of a decoction of its bark having been formerly used for washing mangy dogs. The wood is hard, and is used for many purposes, as making spokes of wheels, skewers, &c. Several species, natives of North America, form ornamental shrubs in this country.

C. florida is a small tree, conspicuous by its large white involucre. Its bark is used in the United States as a substitute for Peruvian bark.

Cornus suecica. A pretty small herbaceous plant, attaining the height of 6 inches, native of this country, especially the north of Scotland, and throughout Europe, being abundant in Lapland, where its red berries are used as food, as also in more northern countries by the Esquimaux.

Cornus canadensis is similar to the preceding, but of larger growth, and is found abundantly throughout the whole of North America, from Pennsylvania to Labrador on the east, and Sitka on the north-west. The berries are also used as food, and in some districts are called Pudding Berries.

Benthamia fragifera. An interesting shrub, native of Northern India, but not sufficiently hardy for the neighbourhood of London. In Cornwall, and some parts of the west of England, it forms a handsome bush, producing abundance of strawberry-like fruit. In India the fruit is used as a preserve, but it is not very palatable.

Aucuba japonica. This well-known interesting shrub is a native of Japan, and was introduced into this country in 1783. Its nature not being known, it was at first kept in the hothouse, but it was soon discovered to be one of our hardiest evergreen shrubs. It is a dicœcious plant, and up to the year 1862 only the female plant was in this country; but through the exertions of Mr. Fortune, the male plant has been introduced, and now numerous red berries are produced on the female plants, which are highly ornamental.

The Witch Hazel Family.

(HAMAMELIDACEÆ.)

Small, deciduous, or evergreen trees, or shrubs. Leaves simple, alternate, with parallel veins running from the midrib to the margin, furnished with deciduous stipules. Flowers in heads or spikes, sometimes contained in an involucre. Petals generally small or wanting. Stamens generally 4, much longer than the petals. Pistils 2. Fruit a capsule, opening by valves.

A small and curious family of plants, consisting of about 18 species, forming nearly as many genera. They are natives chiefly of, and widely spread over, the Northern hemisphere. They possess no peculiar properties for general use, but the following are cultivated in this country:— Witch Hazel (*Hamamelis virginica* and *Fothergilla alnifolia*), natives of North America and hardy in this country; *Parrotia persica*, a small tree of Northern Persia, and its ally, *Corylopsis spicata*, of Japan, have deciduous leaves like the Hazel, and are hardy in this country; *Trichocladus crinitus*, a native of South Africa, was introduced in 1823. It is a rusty-leaved bushy plant growing to the height of about 3 feet. One of the most interesting of the family is *Rhodoleia Championi*, native of Hong-Kong, introduced into this country about twelve years ago. Its flower consists of a large involucrum containing a number of coloured petals, having, as well as the leaves, much resemblance to a Camellia. It grows freely in the greenhouse.

(BRUNIACEÆ.)

A family of from 50 to 60 species, natives of South Africa. They are small shrubs with heath-like, rigid, imbricate leaves. Flowers small, solitary, panicled, or in compact bractæform heads. Stamens 5. Pistil 1.

Several species of *Brunia* have long been cultivated in Botanic Gardens. They do not possess any useful properties.

THE MYRTLE AND BRAZIL NUT ALLIANCE.

The Melastom Family.

(MELASTOMACEÆ.)

Small trees, shrubs, frutlets, or rarely herbs; having opposite simple leaves with a more or less number of parallel veins passing from the base to the apex, the footstalk sometimes swollen. Flowers terminal, solitary, or in racemes or loose panicles, sometimes umbel-like. Petals 4 or 5. Stamens 4—8 or 10. Filaments bent. Anthers long, attached by their side, opening by two pores at the apex. Fruit berry-like, pulpy, or firm and dry, opening at the apex, or sometimes partially valvate. Seeds small, numerous.

This is an extensive family containing 1100 or more species. They are found mostly in moist tropical countries, a few in Australia, very few in North America or Northern India, and none in Europe. They are all harmless, and possess astringent but not noxious qualities, and generally impart a black colour to the mouth.* Some are used as dyes. Many are interesting plants in the hothouses of this country; some having heath-like, and others magnificent, broad, elliptical leaves, 2 to 3 feet in length. In many the flowers are very small and inconspicuous; others large and of showy colours, such as *Medinilla magnifolia*, *Pleroma heteromalla*, *P. Benthamiana*, and many others, all of which however, are exceeded by those of *P. macrantha*, which are of a purple colour, and have a diameter of 3 inches. These and many other showy species are natives of Brazil, New Grenada, and other parts of tropical America. *Rhexia virginica*, a pretty perennial plant, native of the United States, in favourable situations is hardy in this country.

Jamaica Wild Rose (*Blakea trinervia*), is an epiphytal

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* Hence the name *Mela*, black, *Stoma*, mouth.

climbing plant with elliptical three-nerved leaves and pretty pink flowers.

The genus *Memecylon*, which consists of upwards of fifty species, was by some considered to constitute a distinct family, but is now admitted to be a section of *Melastomaceæ*. The principal of them consist of shrubs and small trees, having entire thickish leaves, and differing from *Melastoma* by the veins being pinnate, often obscure. The cultivated species have the habit of myrtles. The leaves of *M. tinctorum* produce a yellow dye, but it is not permanent. Those of *M. umbellatum* are used with Sappan wood to produce a red dye. They are chiefly natives of India and other parts of tropical Asia.

The Myrtle Family.

(Myrtaceæ.)

Lofty trees or shrubs. Leaves entire, opposite, or alternate, sometimes whorled, generally smooth and glossy, containing aromatic oil cells often visible as pellucid dots, many with a marginal vein. Flowers axillary or terminal, disposed in various ways. Calyx 4 or 5 cleft, sometimes circumcised, the upper part falling away like a cap. Petals 4 or 5, stamens generally numerous, free or united in several bundles, seated on an epigynous disk. Pistil simple. Fruit a fleshy drupe, or berry-like, or a dry hard capsule, opening by fissures in the apex. Seeds numerous.

This interesting family contains about 1500 species. They are widely distributed over all tropical countries, and abound in Australia and New Zealand, but are found sparingly in temperate South America and Africa; in Europe the family is represented by the myrtle. None are found in North America or Northern Asia. They contain an aromatic oil, and many are of great importance for timber, especially the genus *Eucalyptus*, some of which are the largest and loftiest trees known.

Pomegranate (*Punica granatum*). A bushy deciduous tree, 20 to 30 feet high, native of Northern India and

Western Asia, extending westward to the countries of the Mediterranean. It has been long cultivated in Spain, and other countries of the South of Europe; and is also now abundant in the West Indies and America. There are several varieties, generally having scarlet, red, or yellowish flowers. The fruit is usually about as large as a full sized apple, having a hard rind of a yellowish colour; it contains a pulp that is highly prized for making cooling drinks. In Persia a wine is made from it in sufficient quantities for exportation. The rind as well as the flowers are used medically as a powerful astringent; it contains a large quantity of tannin, which is used in the manufacture of Morocco leather. A decoction of the bark and root is a powerful remedy for the tape worm. The pomegranate is recorded as being introduced into this country in 1548. It grows freely under the protection of walls, but suffers in severe winters. In January, 1838, the whole in the neighbourhood of London were killed to the ground. The pomegranate is of ancient renown, being mentioned in the Bible as one of the fruits of the Land of Promise, and is also described by Theophrastus 300 years before the Christian era.

Myrtle (*Myrtus communis*). This favourite shrub, although widely spread and cultivated in countries bordering on the Mediterranean, is nevertheless believed to be a native of Western Asia, where in Persia and other parts it is found wild. In favourable situations it forms a small tree 20 or more feet in height, but is often seen of a bushy or shrubby habit. Its wood is hard and mottled, often knotty, and is much esteemed in turnery. An oil is obtained from it, which is used in perfumery, the leaves and flowers constituting what is called sachet powders, pot pourris, &c. The fruit, which is a pulpy black berry, is used in some countries as an aromatic condiment. It was introduced into this country about 300 years ago, and in protected situations it is sufficiently hardy to withstand the ordinary winters of the climate of London. The myrtle is mentioned in the Bible, and is used

by the Jews as an emblem in the Feast of the Tabernacles, but only sprigs of the variety having three leaves in a whorl.

Clove (*Caryophyllus aromaticus*). A handsome bushy evergreen tree, attaining the height of from 20 to 30 feet, having upright branches with smooth elliptical leaves 3 to 5 inches in length. It is a native of the Moluccas, and presents a singular history of monopoly by the Dutch, who restricted the cultivation of the plant to the island of Amboyna, and vast quantities of cloves were destroyed by them at Amsterdam, in order to sustain a certain price. In time, however, the plant was introduced to other islands, and is now cultivated in India, Ceylon, Mauritius, and the West Indies. The whole of the plant is aromatic and affords clove oil; the clove, so well known in culinary use, is the unexpanded flower buds, and not, as generally supposed, the fruit. The name clove has been given to it on account of its resemblance to a nail, from the French word *clou*.

Allspice (*Eugenia Pimento*). A native of the West Indies; it is a handsome growing bushy tree, with smooth elliptical leaves, which are highly aromatic. It is much cultivated in Jamaica, and other West Indian Islands, for the sake of its fruit, which is berry-like, about the size of a small pea, and growing in clusters. It is highly aromatic and pungent, and forms the well-known allspice used in cookery, confectionery, and medicine.

Guava (*Psidium pomiferum* and *P. pyriferum*). Small trees, originally natives of the West Indies, but now universally cultivated in most tropical countries. By some botanists they are considered as distinct species, and by others only as varieties of one species. The chief difference is in the shape of their fruit, one being apple and the other pear-shaped, of a yellow colour outside, the pulp red. They are highly esteemed, and come to this country as a preserve, under the name of Guava jelly and cheese.

Purple Guava (*Psidium Cattleyanum*). Said to be a native of Brazil, but it first came to this country from China, about the year 1820. It is a strong growing species; one of the

original plants, about 20 feet high, was in the Palm House at Kew some years ago, bearing abundance of fruit, which was excellent for dessert as also for preserving; it is much more easy of cultivation than the preceding.

Malay Apple (*Eugenia malaccensis*). A handsome strong-growing smooth-leaved tree, producing a profusion of scarlet flowers from the stem and branches, which is succeeded by abundance of fruit, about the size of a small apple, said to be esteemed in India and other countries of the East; but, judging from fruit produced at Kew, it does not bear out what has been said in praise of it.

Rose Apple (*Eugenia Jambos*). A smaller growing tree than the preceding, and with narrower leaves, producing its flowers at the end of the young branches. It is also a native of the East Indies, but is cultivated in Madeira, and many other warm countries. The fruit is about the size of a hen's egg, and is made into a preserve. *E. Ugni*, a native of Chili, has been introduced into this country within the last few years; it is a small neat-leaved shrub, nearly hardy, and bears fruit abundantly in the greenhouse; but its flavour is not such as to recommend it as a table fruit.

Guava Berry (*Eugenia lineata*). A small tree, native of the island of Tortola. Its fruit is small, and is excellent for dessert; it is likewise used for a preserve, and forms a favourite cordial.

Jambolan Tree (*Eugenia Jambolana*). A large tree, native of India, and cultivated in many parts; its wood is hard and durable; and the bark, which is used for dyeing, is astringent. The fruit is about the size of a pigeon's egg, and is universally eaten.

Cajaput oil (*Melaleuca cajaputi*). A tree, native of the Eastern Archipelago, also found in Eastern and Northern Australia; it has numerous coats of loose white bark, which is used for many purposes by the natives; its most important product is the oil distilled from its leaves, which is of a green colour, and is in great repute as a stimulant; it was at one time considered of great service in cholera.

Gum Trees. Few families surpass this in large timber trees, especially as represented by species of the genus *Eucalyptus.* Their native countries are Australia and Tasmania, where they form large forests. There are not less than from 100 to 150 species described, but they vary so extremely, in different kinds of leaves being produced on various branches of the same tree, thus presenting distinct specific characters, and in the varying nature of their bark, that the determination of species is very difficult. In Tasmania they are described as rising to the height of from 200 to 400 feet, with a diameter of from 6 to 8 feet. Their naked gaunt stems, of 100 or 150 feet clear of branches, present the appearance of a forest of artificial columns. These, sometimes blackened by the fires of the natives, and with the shaggy loose bark hanging about them, afford a grand but dismal spectacle. Trees of equal, if not larger size, are found in Victoria, a fallen one measuring 480 feet in length, while one still larger measured 80 feet in circumference.

According to the nature of their bark, they receive various names, such as Stringy bark (*E. gigantea*), Iron bark (*E. persicifolia*), Blue gum (*E. globulus*), Peppermint tree (*E. amygdalina*) ; some also receive the name of native mahogany, which, with the kind called Grey Iron bark, &c., are imported to this country. The wood of some is very hard and durable, and so heavy as even to sink in water. Many yield gum *E. resinifera*, a gum kino, and *E. amygdalina*, an oil which comes to this country in considerable quantity. *E. mannifera* and others yield sweet secretions analogous to "Manna." It is also stated that *E. Gunnii* furnishes a great quantity of liquid that ferments and forms a kind of beer. They produce abundance of seeds which vegetate freely, and have, through the agency of man, become naturalized in many countries. As they are of robust growth, a "struggle for life" in the natural vegetation is the consequence. Many years ago large quantities were raised at Kew, and experiments tried with them in the open air ; they grew vigorously, and several species withstood ordinary winters, but the severe

cold of January, 1838, destroyed them after having attained the height of 15 feet. Since then a species named *E. polyanthum* has stood for the last twenty years in an exposed part of the garden; it has attained the height of 20 and a girth of 4 feet. The young shoots are occasionally injured, but it is otherwise perfectly hardy, and might become a useful timber tree in the Southern parts of England. Australia also possesses other large trees of this family, such as species of *Angophora*, *Callistemon*, and *Tristania*. A species of the latter yields a fluid-like turpentine, from which circumstance it has received the name of Turpentine tree. In New Zealand, *Metrosideros robusta* and *Callistemon ellipticum* are found, the latter a remarkably large tree, growing in rocky places, and attaining the diameter of 4 or 5 feet; the wood being extremely hard, takes a beautiful polish, and may be compared to Rosewood. Several other species of *Metrosideros* of epiphytal nature, growing to the tops of the highest trees, are also found; like Ivy, they involve and ultimately destroy the trees they surround, but the union of their own stems forming a hollow tree, they entirely lose their epiphytal character. They are very ornamental greenhouse plants in this country, *M. tomentosa*, by its profusion of scarlet flowers, having a striking effect when seen at a distance.

A great number of this family from the Australian Colonies have from time to time been introduced into this country, the Kew collection in 1850 consisting of about 100 species. They are highly ornamental greenhouse shrubs, such as species of the genera *Melaleuca*, *Calothamnus*, *Callistemon*, *Tristania*, *Bæckia*, and others. Many have flowers with long stamens standing out at right angles, which give the idea of a bottle brush. The genera of Myrtaceæ were generally arranged under three sections—viz., *Leptospermeæ*, *Myrteæ*, and *Chamælaucieæ*. The latter has been supposed to have sufficient character to form a distinct family, consisting of about 50 species of beautiful little shrubs, natives of Australia, of which several have been introduced into this country; such

as species of *Calytrix*, *Chrysorrhoœ*, *Genetyllis*, &c., most of them being showy greenhouse plants.

The Mock Passion-flower Family.

(Napoleoneæ.)

Evergreen trees, with alternate smooth leathery leaves, with two glands on the petiole. Flowers solitary, in the axis of the leaves and sides of old branches, 2 to 3 inches in diameter, of a pale-yellow colour. Corolla membranous, spreading, 5-lobed, plicate, crumpled at the margin, becoming reflexed, concealing the leathery 5-parted calyx. Centre of the corolla furnished with two circles of numerous stamen-like appendages (like Passion-flowers). Stamens about 20, united nearly their whole length in five bundles (half being barren). Stigma 4 or 5 rayed. Fruit about the size and like a pomegranate. Ovary 5-celled. Seeds large, kidney-shaped.

A small family, consisting of probably not more than three or four species, the principal representative being *Napoleona imperialis*, a medium-sized tree, native of many parts of Western Tropical Africa. The peculiar and somewhat paradoxical character of its flowers has given rise to many different opinions as to its affinity, the corona and glands on the petioles seeming to indicate its relationship with Passion-flowers; but it is now generally placed in the Myrtle alliance. It has no special qualities, except that the fruit is mucilaginous, and the rind contains tannin.

The Anchovy Pear Family.

(Barringtoniaceæ.)

Large or small trees, rarely shrubs, generally with simple, alternate, large smooth leaves. Flowers sessile on the stems, or in corymbs, showy. Petals 4 or 5. Stamens free or wholly united by their bases in one or several parcels. Fruit bearing the permanent calyx on its apex, fleshy, with

several bony seeds embedded in pulp, or dry and fibrous, containing one seed.

About 100 species constitute this family, all of which are entirely confined within or near the tropics.

Anchovy Pear (*Grias cauliflora*). An erect-growing tree, native of the West Indies. It has few branches, and attains the height of 40 or 50 feet, having large elliptical lanceolate leaves 2 to 3 feet in length. Its large and white flowers are seated on the stem below the leaves, and bear a fleshy fruit of considerable size, much resembling the Mango in taste; in an unripe state it is often made into pickles. The plant is a favourite in the hothouses of this country, and may be considered the largest-leaved tree exogen, one at Kew having produced leaves 4 feet in length by 1 foot in breadth.

Gustavia augusta and *G. speciosa* are also handsome-leaved trees, natives of tropical America, and are with other species of the genus grown in hothouses.

Barringtonia speciosa, a large branching tree, attaining the height of 40 or 50 feet, and a girth of 10 to 14 feet; has large shining smooth leaves, and bears a profusion of pink flowers. It is a native of the Malayan, Polynesian, and other islands of the Pacific Ocean, growing on the sea-shores. It has a flat conical fruit, about 3 inches across the base, and somewhat 4 sided, consisting of solid fibry matter, having only one seed, and when dry is employed for fishing floats.

Fœtidia mauritiana. A considerable sized tree, native of the Mauritius, where it is called Stinking wood, and on account of the white ants not attacking it, it is used for the foundation of houses.

The Monkey Pot Family.

(LECYTHIDACEÆ.)

Generally large trees, having simple, alternate, lanceolate or elliptical leaves, with small deciduous stipules. Flowers

large, showy, sessile on the branches or terminal. Petals 6, seated on an urceolate or leafy calyx. Stamens numerous, three or a portion of them connected, forming a cucullate body, more or less of them sterile. Pistil simple. Fruit a hard-wooded capsule, often of large size, opening by a lid or entire, and globose, indehiscent, containing nut seeds, dry or immersed in pulp.

This remarkable family consists of about 40 species of lofty trees, natives of the countries of the Amazon, Orinoco, and Rio Negro. They are singular for their large hard-wooded capsules.

Brazil Nut (*Bertholletia excelsa*). A tree attaining the height of 100 to 150 feet, and about 3 or 4 feet in diameter. The leaves are broad, smooth, and nearly 2 feet in length. The fruit is produced on the upper branches, and when full grown are in the form of a perfect ball, from 4 to 6 inches in diameter; it consists of a woody shell, containing a number of three-sided rough seeds (nuts), about an inch and a half in length. The fruit when ripe falls to the ground. The nuts are obtained by splitting the shell, and are imported to this country chiefly from Brazil.

Sapucaia Nuts (*Lecythis Sabucajo*). A large tree, with a woody fruit about 6 inches in diameter, of an urn shape, having a lid about 2 inches in diameter, which when ripe falls away, allowing the seeds to fall out; the whole having the appearance of artificial workmanship. The nuts are nearly similar to the last, but rather longer.

Monkey Pot (*Lecythis ollaria*). Also a large tree, but with small leaves, not unlike an elm. The capsule is of the same character as the preceding, but the nuts have a degree of bitterness. The tree is remarkable for having a thick bark of numerous fine layers like paper, that separate freely, and are used by the natives as wrappers for cigars and other purposes. In British Guiana its timber is valuable on account of its being proof against the borings of sea-worms and the attacks of barnacles.

Cannon-ball Tree (*Couroupita guianensis*). A large tree,

remarkable for its fruit, resembling a ball 6 or 8 inches in diameter, circumscribed by a mark; the seeds are embedded in pulp, which, when fresh, is of an agreeable flavour, but when dried or exposed to the air, has a most abominable odour, which it retains for years.

The Mangrove Family.

(Rhizophoraceæ.)

Trees or shrubs, growing on muddy sea-shores, having opposite simple leaves, sometimes with convolute stipules. Flowers solitary, on axillary or terminal footstalks. Petals and stamens rising from the calyx, the parts varying in number. Pistilum 1 short. Fruit woody, indehiscent, 1-seeded, crowned by the permanent calyx.

About 20 species constitute this family, all being natives within or near the tropics, where they form impenetrable barriers for hundreds of miles along the mud shores of low coasts, rising to the height of 15 feet or more, rooting from the branches like the Banyan Tree of India. They are also remarkable in their fruit germinating while hanging from the branch, and producing a root ultimately falling into the mud and forming a new centre. By these means they extend their domain seawards, their roots and branches interlacing in every direction. The exhalations from Mangrove swamps are of a most unhealthy nature, causing malaria and fever. Oysters and other shellfish attach themselves to these plants, thus verifying the once-doubted assertion that oysters grew on trees. They have no special virtues, except that in some parts the bark is used for tanning and dyeing. The typical species of the family is Rhizophora Mangle.

The Mock Orange Family.

(Philadelphaceæ.)

Deciduous shrubs, with simple opposite leaves. Flowers axillary or in terminal racemes or cymes. Calyx adherent,

with 4 to 10 divisions. Petals the same number. Stamens numerous, in two rows, seated on the calyx. Styles distinct, or united. Fruit capsular, consisting of 4 or 10 many-seeded cells.

About 20 or 30 species are recorded as belonging to this family, being widely spread over the Northern temperate zone, and represented in Europe by the well-known shrub called Mock Orange or Syringa (*Philadelphus coronarius*), which, with *P. grandiflorus* and a few other species, are ornamental garden shrubs, conspicuous for their white flowers. *Deutzia scabra* and *D. gracilis* are natives of Japan. The first is a hardy shrub, the leaves of which are covered with curious scales that are beautiful objects under the microscope. The latter is a smaller and more tender species, and has become a favourite as an early flowering greenhouse plant.

THE BEGONIA AND GOURD ALLIANCE.

The Bastard Hemp Family.

(DATISCACEÆ.)

Tall herbaceous plants or trees, with alternate much-divided leaves Flowers in axillary racemes or terminal in panicles (not coloured), unisexual. Fruit a small capsule, opening at the top.

Not more than four species are known of this family. They are widely scattered over the Northern hemisphere, the principal representative being *Datisca cannabina*, a hemp-like plant, native of the South of Europe, possessing no special qualities, except being bitter and purgative, and its roots containing a kind of starch, called *Datiscine*. In India and Java the family is represented by *Tetrameles indica*, a large tree, having simple acuminate, sometimes lobed leaves.

Botanists differ much in opinion respecting the alliance of this small family; some place it near *Resedaceæ*, but Dr. Lindley and others consider it to be more allied to the Gourd family.

The Gourd Family.

(CUCURBITACEÆ.)

Annual or perennial, tuberous rooted, trailing or tendril climbing plants, with soft porous stems, often attaining a great height. Leaves alternate, generally heart-shaped, entire, more or less lobed, or palmate. Flowers unisexual, generally yellow or white, axillary, solitary, or in umbel-like panicles. Corolla 5-parted, or united (gamopetalous), entire or fringed. Stamens generally 5, free, or more or less united. Pistils short. Stigma lobed, thick and spongy. Fruit succulent and fleshy, globose or cylindrical, varying in size from a small berry to from .2 to 3 feet in diameter; or in length from 2 inches to 6 feet; containing numerous flat seeds embedded in fleshy pulp, rarely 1-seeded.

Upwards of 270 species are enumerated of this family. They are chiefly natives of the tropics of both hemispheres. In Europe, and other parts of the north temperate regions, they are represented by the genus *Bryonia*, but are sparingly found in the southern hemisphere, except the culinary kinds, which, by cultivation, are widely distributed over the temperate and warm regions of the earth.

Cucumber (*Cucumis sativa*). According to Bible history this well-known vegetable appears to have been extensively cultivated in Egypt,* in the time of Moses, and still continues to be so, as well as in many other countries at the present day. Gherkins are simply the fruit gathered in a young state, and form a well-known pickle. The principal constituent of "West India Pickles," is the fruit of *Cucumis Anguria*, supposed to be originally a native of tropical West Africa, but now extensively cultivated in the West Indies, and many parts of tropical America.

Melon (*Cucumis melo*). This, like the cucumber, is also of ancient fame. There are a great many varieties cultivated

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* Numbers, chap. xi. ver. 5.

throughout temperate and tropical countries. The finest are said to be the melons of Bokhara. The melon is supposed to have been first introduced from Egypt to Rome, from thence to France in 1495, and after that to England.

Water Melon (*Cucumis Citrullus*). This is extensively grown in hot dry countries for its refreshing juice. It is not much cultivated in this country, but may sometimes be seen in the fruit shops, being imported from Spain and Portugal. It is supposed to be the "melons" of Egypt, the loss of which in the wilderness the Israelites regretted.

Pumpkin Gourd (*Cucurbita Pepo*). Extensively cultivated as a culinary vegetable.

Vegetable Marrow (*Cucurbita ovifera*). Supposed to be a native of Persia. It is an excellent culinary vegetable.

Melon Pumpkin (*Cucurbita maxima*). The largest fruit of the Gourd family, or of any other, some having been grown in this country weighing not less than from 200 to 240 pounds, and measuring from 6 to near 8 feet in circumference. Many other varieties of the Gourd tribe are cultivated for food throughout warm countries, and the hard rinds of the fruits are converted into household bowls, dishes, &c. Amongst the most remarkable may be mentioned the Bottle Gourd (*Lagenaria vulgaris*), which grows abundantly in Egypt and Arabia, and has been introduced into the West Indies. Its fruit, which is sometimes nearly 6 feet long, is shaped like a bottle, and often used as such. The Club Gourd is a variety of this, but is more tapering, in the form of a club.

Choco (*Sechium edule*). A common plant, cultivated in tropical America and the West Indies, for the sake of its fruit, which is about 4 inches in length, 3 inches in diameter, of a green colour, and furrowed of a delicate white inside; it is used as a vegetable.

Colocynth (*Cucumis Colocynthus*). A native of Palestine, and some parts of North Africa. The fruit is about the size of an orange, and may frequently be seen in show bottles in druggists' shop-windows. It is used in medicine. The soft

part of the fruit is poisonous and highly purgative; the seeds are nutty and nutritious, and used as food in some parts of North Africa. The Colocynth is in all probability the "wild gourds" spoken of in 2 Kings, chap. iv. ver. 39—40; as also the vine of Sodom, Deuteronomy, chap. xxxii. ver. 32; as well as the apples of Sodom, described by Josephus, "as resembling edible fruit in colour, but on being plucked by the hand, are dissolved into smoke and ashes." (See Solanum.) It is also supposed to be the fruit that poisoned the soldiers of Xenophon.

Squirting Cucumber (*Ecbalium agreste*). This plant has the same habit and appearance as the cucumber, trailing on the ground but devoid of tendrils. It is a native of the South of Europe, and has long been cultivated in Botanic Gardens as a curiosity. The fruit is about 2 inches in length, and when ripe hangs down at an acute angle with the footstalk; on touching it, it immediately parts from the footstalk, and ejects, with considerable force, a number of seeds and a liquid, to a distance of two or three yards, often striking the unwary toucher in the face, and making him start with surprise. The juice is of a highly poisonous nature, and when concentrated forms the powerful drug called elaterium, which is obtained by pressure of the seeds.

Snake Gourd (*Trichosanthus anguina*). The fruit of this is cylindrical, and about 3 feet in length; but in the Serpent Cucumber or Viper Gourd (*Trichosanthus colubrina*), the length attained is often from 5 to 6 feet, and about 1 inch in diameter, having the appearance of a rope. If the young fruit be inserted in a large glass jar or bottle, the latter will become filled by a succession of coils, exactly resembling a museum specimen of a snake in a bottle.

Cocoon Antidote (*Feuillæa cordifolia*). A native of Jamaica, having palmate leaves, and climbing to a great height over trees. The fruit is globular, 4 or 5 inches in diameter, and contains flat seeds, larger and thicker than broad beans, and is used for the cure of snake-bites. An oil is also

expressed from them, but more abundantly from an allied species native of Peru.

Telfairia pedata. A native of the Eastern Coast of Africa, and found at Zanzibar; introduced into this country by way of the Mauritius. It is a tall climbing plant like the preceding, having dark green palmate leaves; its fruit is from 2 to 3 feet in length, 8 to 10 inches thick, and furrowed. The seeds are like those of *Feuillæa*, each fruit containing several hundred seeds, which yield a fine oil having the flavour of almonds. A plant has been grown to a great length in the hothouses at Kew.

Towel or Sponge Gourd (*Luffa Ægyptiaca*). A native of Egypt, and now grown in many parts of Africa and the West Indies. Its fruit is 1 foot or more in length, and 2 or 3 inches in diameter, having a thin skin and filled with spongy fibre, which, when the skin is removed, is used for a skin-rubber and many other domestic purposes.

Bryony (*Bryonia dioica*). A common British plant that climbs over hedges and adorns them with its beautiful fruit in autumn. Children should be cautioned not to eat the fruit, as it is highly poisonous. It has thick, fleshy, long tuberous roots, often double or made to grow so in order to convert them into the appearance of a man, and are called mandrakes, which are occasionally to be obtained as curiosities. It is a dangerous drastic purgative; indeed, the whole family may be considered as such, and it is only cultivation and cooking that render many culinary sorts harmless.

Gerrardanthus megarrhiza. A remarkable plant, native of Natal, having the habit of *Bryonia*, consisting of a circular tuber corm lying on the surface of the ground, which is 3 or more inches in diameter, and 1 to 2 feet thick. It is acrid and bitter.

The Begonia Family.

(BEGONIACEÆ.)

Herbs or succulent-stemmed fruticuls; erect or creeping, like a rhizome, or sometimes with tuberous roots. Leaves alternate, entire, lobed, palmate or digitate, their base always oblique-cordate, smooth or villose; often red or blotched of various colours. Flowers unisexual, 2 to 3 or more in an umbellate form, or terminal in axillary spikes. Stamens numerous. Stigmas 3, 2-lobed. Fruit a winged, membranous, three-sided capsule, containing numerous small seeds.

This family probably amounts to about 160 species. They are found throughout tropical America and the East and West Indies. It was long supposed none were native of Africa, but within the last few years tropical Western Africa has afforded several species. They do not possess any peculiar qualities, but are highly ornamental hothouse plants, about 100 species, and their varieties being known in cultivation. The readiness with which they hybridize has brought out many remarkable varieties, with singular blotched leaves, some a foot or more in diameter.

FLOWERING NETTLE AND EVENING PRIMROSE ALLIANCE.

The Flowering Nettle Family.

(LOASACEÆ.)

Small shrubs or herbs, annual or perennial, sometimes twining climbers, having opposite alternate, simple, or cut leaves, furnished with stinging hairs. Flowers solitary, on axillary foot-stalks, generally yellow and showy. Petals 5 or 10, in two rows, often folded, hood-like. Stamens numerous, in two rows, of different lengths, free or in bundles. Pistil simple or divided. Fruit a dry or succulent capsule.

Of this family about 70 species are known, all being natives of Mexico and other warm parts of America. They

have no special qualities, but several are ornamental garden plants, such as *Bartonia aurea*, *Blumenbachia insignis*, as well as several species of *Loasa*. *Illairea canarinoides* is a remarkable plant, climbing like the Hop, and producing curious showy pendulous flowers on long foot-stalks.

The Water Chestnut Family.

(HALORAGACEÆ.)

Small herbs, with finely-cut or toothed leaves, growing (floating) in water; or with erect stems and filiform leaves, rarely sub-shrubs with opposite leaves. Flowers small, inconspicuous, variable in number of parts. Fruit small or large, hard, and horned.

From 50 to 60 species are recorded of this family. They are generally insignificant plants, all widely distributed throughout the temperate regions of both hemispheres, and are represented in this country by the two species of Water-Milfoil (*Myriophyllum*), and the common Mares-Tail (*Hippuris vulgaris*).

Water Chestnut or Caltrops (*Trapa natans*). A native of the South of Europe, growing in water, having creeping stems producing tufts of hair-like roots, from the centre of which rise foot-stalks with floating, triangular toothed leaves. The flowers are small. The lobes of the calyx 2 or 4, increasing in size, and with its tube involving the ovary, which becomes a hard, horned fruit about the size of a chestnut. They contain much farinaceous starch, forming a considerable article of food; in Italy they are known by the name of Jesuit Chestnuts, and in France as Water Chestnuts. In Cashmere the seeds of *T. bispinosa* form an important article of food to a large population. *T. bicornis* is also extensively used for food in China.

The stiff horn-like projections of these fruits convey to the mind the idea of Caltrops; hence they are called Water Caltrops (*T. bicornis*). The chief exception to their aquatic character are some species of the genus *Haloragis;* small

shrublet plants, with opposite leaves, chiefly natives of New Zealand, *H. Cercodia* having been introduced to Kew during Captain Cook's first voyage in 1772.

The Evening Primrose Family.

(ONAGRACEÆ.)

Small erect or decumbent shrubs or fruticuls, or more generally annual or perennial herbs. Leaves simple, alternate or opposite. Flowers solitary, axillary or in terminal racemes. Calyx 4-lobed. Petals 4, twisted before expansion, equal or unequal (as in *Lopezia*). Stamens generally 4 or 8, rarely 1 only. Pistil 1, with a round club or 4-lobed. Petal like stigma. Fruit a round or oblong, many-seeded, fleshy berry, or a cylindrical dry 4-valved capsule. Seeds numerous, naked or with a feathery appendage.

Nearly 500 species constitute this family. They are widely dispersed; the herbaceous species, many of which are annuals, are chiefly confined to temperate countries of the northern hemisphere; the shrubby species to Mexico, Chili, Brazil, and New Zealand. In this country the family is represented by several species of Willow Herb (*Epilobium*). They have no special useful properties; but some are highly ornamental out-door plants, such as many species of *Œnothera*, *Clarkia pulchella*, and others natives of California and Oregon. The Evening Primrose (*Œnothera biennis*) is a native of Virginia, and now naturalized in many parts of Europe, being cultivated in Germany for the sake of its roots, which are used as a vegetable. The most attractive of the family are species of *Fuchsia;* the first, known as *F. coccinea*, native of Chili, was introduced in 1788. In 1823, *F. decussata*, also a native of Chili, was introduced, and other species successively followed; and between that time and 1837, the fine Mexican species, *F. fulgens*, *F. cordata*, and *F. corymbiflora*. Since then numerous fine varieties, with showy flowers, have been raised. The fruit of *F. corymbiflora* is wholesome and not unpalatable.

CACTUS AND GOOSEBERRY ALLIANCE.

The Cactus Family.

(CACTACEÆ.)

Fleshy (sarcocauls), leafless (rarely leafy) plants, varying extremely in size and form, being globose, conical, columnar or flat, generally formed of 3 or more angles, or many longitudinal ribs, on which are seated bundles of spines. The stems sometimes with articulated, convex or round branches (as *Opuntia*), or flat and leafy (as *Phyllocactus* and *Epiphyllum*); sometimes very slender, pendulous and cord-like. Flowers solitary, sessile, regular, or sometimes oblique, and 2-lipped. Petals 5, or numerous, the exterior ones becoming colourless, and forming the sepals of the calyx. Stamens numerous, attached on the interior tube of the calyx or corolla; regular or wholly inclined to one side. Pistil one, or its apex lobed or consisting of rays. Fruit pulpy, berry or fig-like; often with fascicles of prickles on the exterior, containing numerous seeds.

The Continent and islands of America must be considered the headquarters of this extensive family; for although several species abound wild in many parts of Africa, Asia, and even in the South of Europe, and being remarkable in appearance are not likely to escape observation, yet they are not noticed or described by ancient writers; it may be inferred therefore that they are not indigenous to the eastern hemisphere, but had their origin in America. In that continent and its contiguous islands they are found widely distributed, extending from Oregon and the Rocky Mountains in the North, to Chili and Paraguay in the South; they grow on rocks, in dry and often very hot places; the common *Melocactus* abounds on the rocky shores of the West India islands.

The family is remarkable for containing in their fleshy substance a great quantity of solid rough grains (as may be

seen by the microscope), termed raphides; and these are so abundant that, on biting a portion, they convey the idea of cucumber dipped in sand. Their juice contains a red colouring matter, which constitutes the basis of cochineal.

Although from the leafless and unplant-like appearance of many species of this family, they in no way resemble the Gooseberry family, the two are nevertheless closely allied in a botanical point of view, and the fruit of many of the Cactæ is as much esteemed and as abundant in warm as the Gooseberry is in temperate countries. They became known in this country as curious garden plants about the end of the seventeenth and beginning of the eighteenth centuries; and in the early years of the present century the number of introduced species recorded amounted to 24, known under the popular names of Melon Thistle, Torch Thistle, Indian Fig, and Creeping Cereus. About fifty years ago, several showy species were introduced from Brazil, such as *Cereus speciosissimus*, *C. speciosus*, *Epiphyllum truncatum*, and others.

About the year 1830, private collections were formed in this country, and through the rivalship of a few rich amateur cultivators, their value rose highly—ten, fifteen, and even twenty guineas being often given for individual plants. This led to speculation, and great importations took place from Mexico and other parts of America, to this country, as well as to Germany; and cultivators were not slow in giving them specific names. They also became objects of study to several botanists, who named and described them independent of one another, thus creating a number of apparent species, and causing much confusion in their names. The number botanically described amounts to above 800; some trade lists enumerate above 780 as being cultivated. During the same period, the Kew collection was increased; but after much trouble and expense, the number in its best days of what was considered to be really distinct species, amounted to only 260, being about one-third of the number said to be cultivated in Germany.

The extreme variation in the different groups of species admits of their being readily arranged under sections, which some botanists consider should be regarded as distinct genera. The following are examples:—

1. *Opuntia* (Indian Fig).

Stems decumbent or erect, branching; branches consisting of flat, convex, or round growths, jointed end to end. Flowers generally yellow and rosulate.

Indian or Prickly Pear (*Opuntia Tuna* and *O. Ficus indica*). Tall growing species are naturalized in Madeira, North and West Africa, and many parts of Asia, giving a picturesque appearance to the old walls of Jerusalem. They attain the height of 20 feet, and are hard, woody, and spinose, forming impenetrable hedges, as is also the case with other allied species. Their fruits are of a red or yellow colour, being about the size and shape of the common fig; and are esteemed for their cooling juice, which contains sugar. These plants, with *O. vulgaris*, abound on the lava slopes of Mount Etna, and are the pioneers of cultivation, their roots penetrating and breaking up the lava, the decayed parts in time forming a rich vegetable mould, on which vineyards are planted. The fruit is collected in large quantities, and sold in the markets, forming an extensive article of food to the inhabitants. It grows abundantly in other parts of the South of Europe, and in Algeria, from which place the fruits are imported to this country. When old, the fibrous parts of the joints of the stems become hard and firm, and are made into ornamental articles.

Cochineal Plant (*Opuntia cochinellifera*). A native of Mexico, where it is cultivated to a large extent, in what are called the Nopal Plantations, for the breeding of the *Cochineal insect;* but *O. Tuna* and other species are also grown for the same purpose. They are now cultivated in Madeira and Teneriffe, from which places a considerable quantity of cochineal comes to this country. The cochineal insect is like a house-bug, and has the same appearance on the

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plant as the white flocky blight on apple trees, or the *Coccus insect*, called mealy bug, often seen in hot-houses. The annual importation of cochineal for the years 1867, 1868, and 1869 averaged over 34,800 cwt.

It forms the finest scarlet carmine dye. The living plant and insect are to be seen in the Royal Gardens at Kew.

2. *Cereus* (Torch Thistles).

Stems erect, arborescent or trailing, some epiphytal; cylindrical, flat, or three, four, five or more angled; or consisting of many ribs. Flowers tubular, often large and of brilliant colours.

Creeping Cereus (*Cereus flagelliformis*). This well-known domestic window plant is a native of Peru, and is recorded as being introduced as early as 1690.

Night-flowering Cereus (*Cereus grandiflorus*). A native of Jamaica and other West India Islands; also early introduced. It is remarkable for its large white and partially straw-coloured flowers, that open in the evening and close early in the morning. It is now, however, surpassed by the flowers of *C. MacDonaldiæ*, a native of Honduras, introduced into this country about twenty years ago, the flowers of which are also of only few hours' duration; when fully expanded it is more than a foot in diameter, thus vieing with the Victoria Lily in size, and when eight or ten flowers are open in one night (as with a plant at Kew), the sight is magnificent. This, like *C. grandiflorus*, is a creeping epiphytal species.

C. speciosus and *C. speciosissimus*, natives of Brazil, have brilliant red and crimson flowers, and are occasionally seen at horticultural flower-shows.

C. Pitaya, and other erect angular-stemmed species, grow abundantly in Western Mexico and other warm parts of America. The fruits of many are luscious, and like the Indian fig, some are of a red colour, which, when many are eaten, colours the secretions of the body.

C. chilensis. A tall-growing species, which loses its suc-

culency, and in age becomes hard-wooded light timber; it is used in Chili for house building and other purposes.

C. giganteus. A native of New Mexico, growing in dry arid places. It has a cylindrical fluted stem, consisting of about twenty ridges, and rises like a column to the height of 50 or 60 feet, having the appearance of posts; the older ones branch at the top, the branches being erect, and when seen at a distance give the idea of a toasting-fork. The fruit is analogous to the Indian fig.

C. senilis. Also a native of Mexico, in the district of Real del Monte, where it grows in a hot valley, called Terra Calientes. It has a tall cylindrical stem, consisting of many ridges, growing to the height of 20 or 30 feet, with a diameter of 9 to 10 inches. In 1846 about 100 plants were received at Kew, varying in size from 1 to 3 feet, while three specimens were from 8 to 12 feet high. In the greater number of them the roots were on one side at a right angle with the stem, clearly showing that they were grown in crevices of rocks. The whole aspect of the plant is of a grey colour, the top part being furnished with long white hairs and spines, which has led to its being called the Old Man Cactus. The stem of this plant contains a large quantity of oxalate of lime in small sand-like grains, which renders it very heavy and brittle.

3. *Epiphyllum.*

Stems branching, composed of short truncate joints. Petals of the flower unequal in size, forming an oblique bilabiate flower.

This section is represented by *E. truncatum* and *E. Russellia*, natives of Brazil, and growing on trees. They have been long introduced into this country, and are much cultivated as ornamental plants for their crimson flowers.

4. *Echinocactus* (Hedgehog Cactæ).

Plants of more or less oblong, globose, conical shape, rarely plain or few angled, generally composed of numerous project-

ing ridges, furnished with straight or hooked hard spines, apex generally concave, from round the centre of which rise the flowers, being either white, yellow, or crimson, and opening successively for several days during sunshine.

This group consists of a number of species, varying considerably in size, some not exceeding a few inches in diameter and height, and others increasing in size even to 3 feet in diameter and 10 feet in height, the largest being represented by *E. visnaga*, of which two plants were received at Kew, about twenty-five years ago, from St. Luis Potosi, one measuring $4\frac{1}{2}$ feet in height, and $2\frac{3}{4}$ feet in diameter, weighing 713 lb.; the other 9 feet in height, rather more than 3 feet in diameter, and weighing about one ton.

The whole of *Echinocactæ* are of slow growth, living to a great age, plants being observed to differ little in appearance during a period of 24 years. Their substance consists entirely of soft fleshy pulp, containing a quantity of water, which is used where water cannot be obtained, their great abundance affording an inexhaustible supply. Mules and other animals break them up and suck them. The Indians also scoop them out and form them into kettles for cooking their food.

5. *Melocactus* (Melon Cactæ).

Plants consisting of ridges like Echinocactus, *but differing in its flowers, which are small, being borne amongst a thick, compact mass of red-coloured woolly fibres and prickles, varying, according to age, from a few inches to nearly a foot in length, and two or three inches in diameter, forming a turban-like head.*

The principal species of this group is *Melocactus communis*, a native of the rocky coast of many of the West India islands, and is well known for its curious head of flowers, called Turk's cap, or Pope's head.

6. *Mamillaria.*

Plants globose, oblong or cylindrical, seldom exceeding a foot

in height, composed of numerous projecting tubercles, like teats, of various lengths and forms, bearing on their apex a tuft of hairs and spines of a yellow or white colour; often being very dense, and have been compared to balls of wool or cotton. They generally grow in tufts, and possess no peculiar qualities; their flowers are small, and the fruit of many, which is of red colour, has the flavour of fried beef.

7. *Rhipsalis* (Mistleto Cactæ).

Stems slender, cord-like, pendulous or suberect and branched, shrub-like; branches cylindrical, angular or flat and leaf-like, jointed with the stem and to one another. Flowers small. Fruit white or red, the size of currants.

About a dozen species belong to this genus; they are found growing on trees, extending from Mexico to South Brazil.

R. Cassytha, a native of the West Indies, where it grows from 1 to 6 feet long, hanging from the branches of trees like cords. This, with several other species, judging by their appearance, seem to have little relationship with Cactæ as generally seen; but they agree in the character of their flowers, fruit, and mode of growth. The white berries have some resemblance to Mistleto.

As already stated, it was generally believed that Cactæ were not originally indigenous to the Eastern hemisphere; but during the last fifteen years several species of *Rhipsalis* have been found undoubtedly wild in several parts of Tropical Africa, as well as in Mauritius and Natal.

8. *Pereskia* (Barbadoes Gooseberry).

Stems woody, leafy, climbing or trailing like brambles, and furnished with strong spines. Flowers rosulate pink.

The principal species is *P. aculeata*, a native of the West Indies. It differs from the rest of the Cactus family in having true leaves. The fruit is about the size of a gooseberry, and is made into a preserve. *P. grandiflorus* is a

strong-growing species, with a hard woody stem, several inches in diameter, and densely covered with long black spines of formidable character.

The above are the principal divisions under which Cactæ are arranged; several individual species have been characterized as distinct genera, but they are only of botanical interest. The family is well represented at Kew.

(HOMALIACEÆ.)

A family of about 30 species of trees or shrubs, having alternate leaves, and Cactus-like flowers (furnished with glands), in spikes, panicles, or racemes.

They are natives of the tropical regions of both hemispheres, and hold an intermediate position between Cactaceæ and Loasaceæ. They have no special uses, except that the roots of some are said to be astringent.

The Gooseberry Family.

(GROSSULARIACEÆ.)

Shrubs, with or without spines. Leaves alternate, simple, more or less angular or lobed. Flowers solitary or in spikes or racemes, furnished with small bracts. Petals and stamens 5 each. Fruit a pulpy berry, bearing the remains of the calyx on its apex, containing a few or numerous seeds.

About one hundred species constitute this family, all natives of the Northern hemisphere, being found in Europe, North America, and temperate Asia. The whole are contained in the genus *Ribes*.

Gooseberry (*Ribes grossularia*). This well-known fruit needs no description.

There are many varieties cultivated. In Scotland they are called Grosets or Grosards, which is derived from the French, meaning rough, rude, and large; it being the largest berry.

Black Currant (*Ribes nigrum*), Red Currant (*R. rubrum*), and White Currant, a variety of the latter. These, with the

gooseberry, are natives of this country, but have been greatly improved from the wild state by cultivation. The currant takes its name from the grape currant, which at first came from the Island of Corinth. Several species, such as *R. sanguineum*, *R. aureum*, and *R. speciosum*, natives of North America, are highly ornamental garden shrubs.

The Escallonia Family.

(Escalloniaceæ.)

Evergreen shrubs or rarely small trees. Leaves alternate, simple, smooth, or with lepidote viscid scales, or resinous, often with toothed glandular margins. Flowers solitary, in spikes, racemes, or corymbs, generally red or white. Petals 5. Stamens 5 or 6. Fruit a capsule or berry, crowned with the persistent calyx.

This family consists of about 60 species, the greater number belonging to the genus *Escallonia*, natives chiefly of South America, principally Chili, and extending to the Straits of Magellan. In Tasmania the family is represented by the beautiful laurel-leaved, small tree, *Anopteris glandulosa*, and in New Zealand by *Quintinia serrata*, also a small tree covered with lepidote scales; and in North America by the pretty garden shrub, *Itea virginica*. They possess no particular qualities, except that some of the resinous-leaved species of *Escallonia* emit a strong odour, especially after rain or on calm summer evenings, so much like the smell of pigs that, at Kew, a piggery at a considerable distance from where the plant was growing was innocently blamed as a nuisance.

The Myrobalan Family.

(Combretaceæ.)

Trees, climbing or twining ampelids. Leaves simple, alternate or partially opposite, sometimes with glands on the foot-stalk. Flowers in spikes or racemes, axillary or termi-

nal (some unisexual). Petals 4 or 5, or absent. Stamens 8 to 10 or more, generally longer than the petals. Pistil simple. Fruit a fleshy drupe, or dry and winged, containing an Almond-like kernel.

This family, of which there are about 200 species, are wholly confined to the Tropics. They have no special medicinal qualities, but are of an astringent nature.

Pentaptera glabra. A tree, native of Pegu and other parts of India, attaining the height of 60 to 80 feet, and it is said 6 to 8 feet in diameter. The wood is hard and durable, and is employed, like teak, for shipbuilding. A kind of lime is obtained by calcining the bark and wood, which is preferred to other lime for chewing with the Betel nut.

Myrobalans are the fruit of *Terminalia Chebula* and *T. Bellerica.* They are large trees, natives of India, characterized by having narrow lance-like leaves growing in tufts on the top of the branches, with elliptical fruit from 1 to 2 inches in diameter, slightly angular, colour of a greenish yellow, and when dried of a brownish black. They are used for tanning and dyeing black, and at least 2000 tons or more have been known to be imported to this country yearly. The fruit of *T. Catappa* has kernels like an Almond, and is eatable.

The genera *Combretum*, *Poivrea*, and others contain a number of species, with hard-wooded climbing stems, which branch and extend to a great length, many of them having showy flowers. About 14 species have been cultivated at Kew, the most splendid being *Poivrea coccinea*, a native of Madagascar, having large racemes of scarlet flowers.

Combretum guayca. A native of the countries on the Orinoco. It is a strong climber, and is remarkable for containing a great quantity of gummy matter, which exudes in abundance on the bark being cut, and is used by the carpenters of Angostura for the same purpose as animal glue. Another species is *C. butyrosum*, a native of South East Africa, producing a peculiar substance like butter, called by the Caffres, Chignite; it is white and hard, somewhat aromatic,

and is taken to Mozambique as an article of commerce. It is not known if this substance is obtained from the stem or the kernel of the fruit, and some doubts are entertained as to its really being the produce of a *Combretum*, but judging by the gluey substance obtained from the preceding species, it seems not improbable that a kind of butter may be produced by an allied species.

A small family, called *Alangiaceæ*, comprises about 8 or 10 species; small trees, natives chiefly of India; several species of *Nyssa*, called the Tupelo tree, being natives of North America. They have all simple entire leaves, and agree in some respects with *Myrtle*, *Myrobalan*, and other allied families. They possess no special properties.

* * *Ovary superior.*

† *Stamens perigynous.*

FIG-MARIGOLD AND HOUSE-LEEK ALLIANCE.

The House-leek Family.

(Crassulaceæ.)

Herbs, frutlets, or small shrubs, with succulent, fleshy stems and leaves, which are alternate, opposite, distant or compact, rosulate, entire, or divided. Flowers generally in umbel-like cymes, one-sided spikes, or panicled racemes, yellow, white, red, or pink. Stamens 5, 10, or more. Pistils generally 5. Fruit consisting of several free follicles, or united, forming a capsule.

Nearly 500 species constitute this family, of which about 100 are found throughout Europe, on the shores of the Mediterranean and in the Canary Islands; about one-fourth of the whole number in South Africa, and the remainder in Northern Asia, Japan, and Mexico. They generally grow in hot, dry, rocky places, their succulency preserving them through the most prolonged drought.

House-leek (*Sempervivum tectorum*). A well-known do-

mestic plant, often seen growing on the roofs of cottages and outhouses. In Ireland it is regarded as a charm, the patch of House-leek on the thatched roof conveying to the poor inhabitants a feeling of more security than the plate of a fire-insurance company, they considering it as a safeguard against fire. In Scotland it is called "fuets." House-leek is a common remedy for the cure of warts and corns.

The genus is represented by a number of hardy as well as greenhouse species, of which *S. tabulæforme* is curious in having a rosette of leaves quite flat, like a round inlaid table, while in *S. calyciforme* they are turned up, and form a beautiful cup.

Navelwort (*Cotyledon umbilicus*). A native of England, but rare. It has round, succulent, shield-like leaves; and, like the house-leek, is a common remedy for corns, warts, &c.

The genus *Crassula* consists of a great number of species, natives of the Cape of Good Hope; many of which are cultivated for their showy red flowers, especially *C. falcata* and *C. coccinea*. The latter has, however, of late years come into bad repute for its narcotic qualities, symptoms of poisoning having in some instances followed the mere smelling of the flowers, the effect in some cases continuing for several days, even requiring medical aid. As it is a favourite window plant, it is advisable that it should not be kept in confined rooms.

Live-leaf (*Bryophyllum calycinum*). The leaves of this plant are very tenacious of life, producing young plants on their margin, even after the leaf has been long separated from the plant. It is supposed to be a native of the Mauritius.

The family is represented in Mexico by *Echeveria*, of which there are many fine specimens in the Kew collection; in this country and throughout Europe by several species of *Sedum*, of which *S. acre* is well known as ornamenting walls and dry gravelly places with its beautiful yellow flowers. In alliance with this family is *Fouquiera*, a singular, straggling, hard, shrubby, spiny plant, native of

dry places in Texas and the Western States of America, its abundance giving a peculiar feature to the landscape. It has small leaves; and on these falling away, the midrib on the under-side becomes a stiff spine. Some botanists consider it the type of a distinct family.

The Fig-Marigold Family.

(MESEMBRYACEÆ.)

Erect or prostrate fruticuls or frutlets, rarely shrubs, with thick, succulent opposite leaves. Flowers solitary on footstalks, consisting of numerous petals and stamens of brilliant colours, opening during sunshine. Fruit a capsule embedded in the calyx, which becomes thickened, generally opening in rays, and hygrometric.

Above 350 species are enumerated in this family, the greater portion belonging to the genus *Mesembryanthemum*. With few exceptions, they are natives of South Africa, growing in dry, hot, sandy places. They vary exceedingly in the form of their leaves, which are always opposite, being flat, cylindrical, thick and fleshy, often three-sided, with toothed margins, resembling the jaws of different animals. Hence the names Tiger-jaws, *M. tigrinum;* Dog-jaws, *M. caninum;* Cat-jaws, *M. felinum*, &c. They also contain numerous needle-shaped raphides. The capsules, after ripening, shut and expand according to the moist or dry state of the atmosphere; and on that account have been brought to this country as curiosities.

At one time this genus was in great repute with botanical amateurs, the Kew collection, a few years ago, containing not less than 250 species.

Hottentot Fig (*Mesembryanthemum edule*). A trailing species, taking its name from the calyx becoming large and fleshy, in shape like a fig; it is eaten by the Hottentots. The same may be said of *M. æquilaterale*, which are eaten by the natives of Australia. They are watery and insipid.

Ice-plant (*M. crystallinum*). This is frequently seen as a curious summer annual in gardens, its leaves glistening on the hottest day as if frozen with ice. Its native country is said to be Greece, but it is widely spread over the coasts of the Mediterranean: it is also found in the Canary Islands and Cape of Good Hope. The ashes of this and two other allied species produce an alkali which is used in glass-making. The Hottentots and other natives of South Africa apply the leaves of *Mesembryanthemum* to many purposes medicinally, and also for rubbing the skin of their new-born children.

M. fragrans and *M. nocturnum* are exceptions to the general rule, as the flowers open in the evening. The latter is a yellow-flowered species, and very fragrant.

Bitter-root (*Lewisia rediviva*). A remarkable plant, deviating from the character of the family. It has long fleshy tap-roots, about the thickness of young radishes, producing a rosette of succulent leaves, from the centre of which rises a brilliant pink flower that opens only during sunshine, and, with the leaves, is of short duration. It is a native of North America; in Canada it is called Bitter-root, and in Oregon Spathulum. The root is white internally, almost entirely composed of starch, and might with propriety be called Starch-root. It is largely collected and used as food by the Indians, and also by Europeans in those regions, even although it has a strong bitter taste. It received the specific name *rediviva* on account of the tenacity of life in the roots, one having been known to grow and flower after being two years a herbarium specimen. With the exception of a single species of *Mesembryanthemum*, it is the only other representative of the family in America.

Formerly this family was termed *Ficoideæ*, and included the genera *Tetragonia*, *Aizoon*, *Sesuvium*, *Galenia*, and several other modern genera, amounting to between 60 and 70 species, which some botanists have considered as forming a distinct family, under the name of *Tetragoniaceæ*. They possess the same general habit as *Mesembryaceæ*, differing

chiefly in their flowers being small, without petals, and with few stamens.

They are widely distributed, growing on hot sandy shores and dry plains, the most important being

New Zealand Spinach (*Tetragonia expansa*). An annual prostrate plant, with dark green leaves. It was discovered in New Zealand during Captain Cook's first voyage, and was much prized as a fresh vegetable by the ships' crews. It has since been found wild in many other countries.

It was early introduced into England, and in some gardens is cultivated as a substitute for Spinach, being wholesome, but of rather a slimy nature.

The small family, *Scleranthœ*, is also referred to this alliance. It consists of about a dozen species of small-leaved frutlets or herbs. Flowers destitute of petals. Represented in this country by *Scleranthus annuus* and *S. perennis*. Known as Knawell.

Turneraceæ.

Herbs or partially shrubby frutlets of a weedy nature. Leaves alternate, simple, with glands on the petiole. Flowers solitary, axillary, yellow, their peduncles, often united with the leaf. Calyx 5-lobed; petals 5, twisted in the bud. Stamens 5 ; fruit a 3-valved 1-celled capsule, only the upper half opening.

About 60 species constitute this family, all being natives of the West Indies and tropical America. *Turnera ulmifolia* is a pretty hothouse plant, curious in the footstalk of the flower being united with the leaf.

Samydaceæ.

Small trees or shrubs, sometimes spiny, with alternate simple leaves, containing pellucid oblong markings. Flowers small, axillary, solitary or many together. Fruit a leathery 3 to 5-valved 1-celled capsule, pulpy inside, with numerous seeds.

About 80 species are enumerated in this family, natives chiefly of tropical America. They are only of botanical interest; several species are to be seen in the national collection at Kew.

In alliance with *Samydaceæ* is a small family called *Lacistemaceæ*. It consists of about 6 species, natives of tropical America, and in habit are said to resemble some of the Pepper family.

PASSION FLOWER AND PAPAW ALLIANCE.

The Passion-flower Family.

(Passifloraceæ.)

Small trees or tendril climbing ampelids, often attaining a great length and height. Leaves alternate, simple or lobed; the footstalks generally bearing glands, and furnished with stipules. Flowers axillary or terminal, sometimes in long spike-like racemes; generally large and of showy colours (rarely unisexual). Calyx 5-parted or combined, forming a tube. Petals 5, seated on the calyx (sometimes absent), generally furnished with a filamentous corona. Stamens 5, monadelphous. Pistil 3-parted. Stigmas thick. Ovary pedicellate. Fruit succulent, pulpy, containing numerous seeds.

The greater number of the 200 species enumerated in this family are natives of Brazil and the West Indies, as well as other parts of tropical America, where they climb from tree to tree, interlacing in the most complex manner, and beautifying the scene by their showy flowers. A few are found in North America, one or two in the East Indies, two in Norfolk Island and Australia. *Smeathmannia*, a genus of small erect trees, represents the family in the tropical regions of Western Africa. The stems of some of the climbers attain the thickness of the arm, and look like ropes; their vascular structure is very open, containing a large quantity of water. A stem of *Passiflora actina*, when cut at Kew, yielded nearly a gallon of pure water in about one minute. A great many are cultivated in hothouses for the sake of their showy

flowers, and the common Passion-flower (*Passiflora cærulea*) is hardy in the open air when trained against walls.

Granadilla (*Passiflora quadrangularis*). Varieties of this are found throughout tropical America. The fruit is of an oblong form, about 6 inches in diameter, some even weighing 3 lbs. When ripe it is of a greenish-yellow colour, and contains a soft pulp of a sweet acid flavour, very grateful and cooling in a hot climate. It fruits readily in the hothouses of this country.

Water Lemon (*Passiflora laurifolia*). This produces an oval fruit of a lemon colour, about the size of a peach or nectarine, full of watery pulp, which is very agreeable.

Passiflora edulis is abundant in the West Indies, and has been successfully fruited in hothouses. The fruit is of a light purple colour and oval, the size of an egg, and is of an agreeable and cooling taste.

Conch Apple or Nut (*Passiflora maliformis*). A smaller fruit than the Water Lemon, but similar in flavour.

Wild Water Lemon, or Love in a Mist (*Passiflora fœtida*). The fruit of this is about the size of a small cherry, the pulp of which is very delicate; but the smell of the leaves is very unpleasant.

Passiflora tetrandra represents the genus in New Zealand, being a slender climber, with narrow lanceolate, smooth leaves and small flowers, differing from the rest of the family in having 4 petals and 4 stamens.

Allied to *Passifloraceæ* is a small family called *Malesherbiaceæ*, containing about half a dozen species, natives of Chili and Peru. They consist of herbaceous or frutlet plants, with showy flowers. *Malesherbia linearifolia* has been cultivated and flowered at Kew.

The Papaw Family.

(Papayaceæ.)

Soft trees or shrubs. Leaves alternate, lobed, on long footstalks of a soft succulent texture. Flowers axillary, some-

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times on the stems below the leaves, solitary or in short racemes, unisexual. Fruit succulent, gourd-like.

A small family, not exceeding 30 species; the whole, with the exception of the genus *Carica*, being natives of temperate and tropical countries of the Eastern hemisphere. The species of *Carica* are natives of tropical America and the West Indies.

Papaw Tree (*Carica papaya*). A small tree, about 20 feet in height, thick and gouty at the base, and of a spongy texture, bearing a crown of palmate leaves on long stalks. Fruit 8 to 10 inches long, of a yellow colour, and shaped like a vegetable marrow; some round like a melon. It is cultivated in most tropical countries, and the juice of the fruit and leaves has the singular property of making fresh animal flesh quickly tender; this is effected even by simply hanging the flesh in the tree under the leaves. The leaves are also saponaceous, and are used as a substitute for soap. The milky juice of the young fruit is admitted to be a powerful vermifuge. They are also used in curries, and made into preserves and pickles.

Carica spinosa. A branching tree, 20 to 30 feet high, native of Guiana and Brazil. The juice is exceedingly acrid, causing blisters to the skin, and is much dreaded. The fruit is not eaten; and the flowers have a carrion-like odour.

In alliance with *Papayaceæ*, is a small family called *Pangiaceæ*, consisting of about a dozen species of large trees, with simple, entire, partially lobed, alternate leaves, unisexual flowers, and succulent fruit (in some about the size of an apple), containing fatty albumen. They are natives of Ceylon, India, and Malay Islands, and are chiefly represented by species of *Hydnocarpus;* they all possess highly poisonous qualities. The bruised seeds of *H. inebrians* are used for poisoning fish, and also for the cure of skin diseases throughout India.

Panguim edule, a native of Java, has hard solid wood; the bark is used for poisoning fish, and the nuts, when macerated

in water, are rendered partially wholesome, but are used only as a condiment.

APPLE, ROSE, AND PEA ALLIANCE.

The Virginian Allspice Family.

(CALYCANTHACEÆ.)

Shrubs with square stems, which, besides the true central axis, have imperfect lateral ones. Leaves opposite, simple, oblong or elliptical, generally rough. Flowers solitary, axillary, or terminal; sepals and petals numerous, running into one another, their united bases forming a tube. Pistils numerous; ovaries embedded in the tube of the calyx, which becomes the fruit.

A small family, consisting of probably not more than six or eight species, remarkable for their curious structure and the aromatic fragrance of their wood and flowers. They are represented in North America by the Carolina Allspice (*Calycanthus floridus* and *C. occidentalis*), and in Japan by *Chimonanthus fragrans*, which are well known in gardens, the latter having pale yellow flowers that open in January, when the plant is destitute of leaves; the two former are dark brown, and flower in summer.

The Apple Family.

(POMACEÆ.)

Trees or shrubs, sometimes spiny, with alternate, simple, entire, lobed or winged leaves. Flowers solitary or in spikes or fascicles. Petals 5. Stamens numerous, free, seated round the margin of the tube of the calyx, which becomes thickened. Pistils 1 to 5. Ovary 5-celled, united and becoming immersed in the thickened fleshy calyx, forming a fruit called a Pome or Apple.

This family consists of about 200 species, almost entirely confined to temperate countries in the Northern hemisphere.

They are valued for their fruits; none are of a poisonous nature.

Apple (*Pyrus malus*), Pear (*Pyrus communis*). These in their crab, or wild state, are natives of temperate Western Asia and of Europe. Apple trees and apples of gold* are spoken of in the Bible, but it is supposed to mean the citron, as there is no certain evidence of the Apples or Pears of the present day being known to the Hebrews, except in the wild crab state. They nevertheless appear to have been used as food by the inhabitants of the prehistoric lake cities of Switzerland, where remains have been found in a carbonized state. The Pear was early cultivated by the Romans, but it is only within a few hundred years, or even a later period, that the numerous fine sorts of both apples and pears have been produced by the skill and art of cultivation. Although apples are abundantly produced in this country, they nevertheless form an important article of import from the continent and United States. The purposes to which they are applied in culinary uses, confectionery, and wine-making, are numerous and well known. Cider is the fermented juice of the fruit, and is extensively made in the southern and western counties of England.

Pears are an uncertain crop in this country, the supply of the best fruits being imported from France and the Channel Islands, where all the fine varieties originated. The fermented juice forms the well-known drink called Perry. The pear lives to a great age, even to several hundred years; the wood in old trees is hard and much valued by turners and cabinet-makers.

Mountain Ash or Rowan Tree (*Pyrus aucuparia*). A small tree, native of this country; it attains the height of 20 or 30 feet, having erect branches and winged leaves. It is highly ornamental in autumn and winter, with its beautiful red berries, which are rough to the taste and not much eaten, but afford abundance of food to the feathered tribe.

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* Prov. xxv. 11; Song of Solomon, ii. 3, 5; Joel, i. 12.

It is one of the trees of superstition, and in olden times, especially in Scotland, was held in high repute as a preventive against witchcraft. It was commonly planted near cow-houses and stables; pieces of the tree were even placed inside, and there is a common saying, "Rowan tree and red thread puts the witches to their speed."

Service Tree (*Pyrus sorbus* or *Sorbus domestica*). A large spreading branched tree with winged leaves. It bears an oblong or round fruit about the size of a large gooseberry. It is a native of various parts of the continent, especially France and Italy, where it is much valued for its hard wood, which is used for making cogs of wheels, blocks, pulleys, &c.; it takes a high polish. The fruit is acerb and not much used, but in Brittany a drink like cider or perry is made from it which has a most unpleasant odour. This tree grows in Cornwall and is considered to be indigenous.

Whitebeam Tree (*Pyrus aria*). A tree with oblong serrated leaves of a snow-white on the under side. It is found wild in some places in this country, but is more abundant on the continent. The wood is hard and used for the same purposes as the preceding. The fruit is acerb.

Quince (*Cydonia vulgaris*). The quince is found wild in many parts of Europe and Northern Asia. It appears to have been early cultivated by the Greeks and Romans, and has been known in this country for more than three hundred years. The fruit is of powerful odour and is often used for flavouring marmalade and other preserves; wine is also made from it. In the heathen mythology the Quince was devoted to the goddess Venus, as being the emblem of love, happiness, and faithfulness; and has been supposed to be the golden fruit of the fancied garden of the Hesperides defended by the dragon. The Japan Apple, or rather Quince, is the beautiful red flowering shrub known in gardens as *Cydonia japonica*. *C. sinensis*, the Chinese quince, has fruited at Kew, but is inferior to the common quince.

Medlar (*Mespilus germanica*). A small spreading tree or bush, native of Europe. It is found in hedges and unculti-

vated places in this country. The fruit is about the size of a very small apple, having the lobes of the calyx well developed, and permanent on its apex. It is unfit for eating when fresh gathered, but after several weeks' keeping the pulp becomes like an over-ripe pear; it has then a pleasant subacid flavour.

Loquat or Japan Medlar (*Eriobotrya Japonica*). A tree of considerable size, with large, elliptical, rough, strong veined leaves. In Japan and China it is cultivated for its fruit, which is about the size of a small plum, and is produced in clusters. It is cultivated in the Australian colonies and in France and other parts of the South of Europe, where it fruits abundantly, but is not sufficiently hardy to bear the severe winters of this country.

Hawthorn, or Quick (*Cratægus oxycantha*). This well known hedge-tree is a native of most parts of Northern Europe and Asia. When grown singly it attains the height of 20 or more feet, and lives to a great age; it is, however, principally used for forming hedge fences. There are several varieties, both in the colour of the fruit and in having single and double flowers; the common White May is sweet smelling, but the variety with scarlet flowers has a very disagreeable odour. The Glastonbury Thorn is a variety which flowers in early spring, or even at Christmas, if the weather is mild. In this country the berries are called Haws.

Cratægus Aronia. A bushy-growing species, similar in habit to the preceding, having a red fleshy Haw fruit. It is a native of the South of Europe and Western Asia, and is common about Jerusalem, especially on the Mount of Olives, where its fruit is collected for preserves.

Besides the above, many form highly ornamental trees and shrubs in the gardens of this country, such as Siberian Crab (*Pyrus baccata*), bearing abundance of fruit about the size of cherries, and eatable. *P. spectabilis*, native of China, bearing a profusion of pink flowers; while *Mespilus canadensis* is one complete sheet of white, and is known as the Snowy Mespilus. There are also many species of *Cotoneaster*, very ornamental.

The Burnet Family.

(SANGUISORBACEÆ.)

Slender shrubs, frutlets or herbs with alternate, simple, lobed or winged leaves, furnished with stipules. Flowers small, generally in round, cylindrical or spike-like heads, or solitary, often unisexual. Petals often absent. Stamens 2, 4, or many. Ovary (rarely 2) becoming a 1-seeded nut embedded in the tube of the calyx, which is winged, as in *Margyricarpus*, or spiny, as in *Acæna*.

About 120 species constitute this family. They are widely dispersed over the temperate regions of both hemispheres, being represented in South Africa by the extensive genus *Cliffortia*, while species of *Acæna* are found in Australia, New Zealand, South and North America; *Poterium* and *Sanguisorba* are European.

Burnet (*Sanguisorba officinalis*). A hardy perennial plant, with winged leaves, producing branching flower stems 3 feet high and bearing oblong heads of reddish flowers. Its ally, *Poterium Sanguisorba*, being of smaller size, is called the lesser Burnet. They are natives of this country, and are grown in gardens for their leaves, which are used in soups, salads, and for cooling drinks.

Parsley-piert (*Alchemilla arvensis*). A small annual, native of this country, growing in waste places and fields, often a weed in gardens. In some places in England it is called "Fire Grass," and is found to be highly beneficial in erysipelas.

Acæna Sanguisorba, a trailing Burnet-leaved shrub, used in New Zealand as a substitute for tea, while *A. ovina* is the pest of sheep pastures in Australia and Tasmania, the hooked spines of the fruit adhering to sheep render the wool difficult to clean.

The Rose Family.

(ROSACEÆ.)

Erect or trailing, generally spiny shrubs, frutlets or herbaceous perennials, having entire, lobed or winged leaves,

furnished with stipules. Flowers solitary, in spikes, panicles, racemes, or corymbs. Calyx 4- or 5-lobed. Petals 5. Stamens of a definite number or numerous. Ovary solitary or many, free or united and dry, as in *Potentilla*, *Geum*, and *Spiræa*; or embedded in pulp, as in *Fragaria* and *Rubus*; or contained within the cup of a thickened persistent calyx, as in *Rosa*. Fruit a single-seeded achenia, or feathered or many-seeded follicle, which is often tailed and spiny.

Besides the typical genus *Rosa*, this family consists probably of about 500 species, natives chiefly of the Northern hemisphere, many differing extremely in appearance from that of the Rose. The whole are innoxious, their principle being of an astringent nature, and, with the exception of the fruit-bearing ones, chiefly valued as beautiful or interesting plants.

Roses. The genus *Rosa* consists of a great number of species, extensively spread over Europe, temperate Asia, and North America, about a dozen and half being natives of Britain. All in their wild state have single flowers, such as Dog Rose (*Rosa canina*), the fruit of which is known as Hips; Scotch Rose (*R. spinosissima*); Sweet-brier or Eglantine (*R. rubiginosa*). Roses with double flowers were, however, known in early times, such as different varieties of Provence Rose (*R. provincialis*); Damask Rose (*R. damascena*); Cabbage Rose (*R. centifolia*); Musk Rose (*R. moschata*); all being originally introduced from France about three hundred years ago. The Moss Rose (*R. muscosa*), is recorded as being introduced in 1724. During the last fifty years, great attention has been paid in France, as also in this country, to the cultivation and improvement of Roses, numerous fine hybrids having been raised between European and Chinese species. They are not only in favour as ornamental plants, but are largely cultivated at Mitcham in Surrey, as well as in many parts of France, for the sake of their petals. They are very extensively cultivated in Cashmere, Persia, Damascus, Upper Egypt, Barbary, and Adrianople, in which latter place many thousand acres of land are

occupied with them. In this country the seasons are not hot enough to ripen the petals for any other purpose than making rose water, which is obtained by simple distillation. By other processes oil and atta (or as in this country called otto) of roses is made, the finest coming from Cashmere, but the largest supply to Europe from Adrianople. It is seldom to be had in a pure state, being mixed with oil of geranium, and also olive oil, and sold in druggists' shops as hair oil. Spirit of Roses is also obtained by distilling the petals with a small quantity of spirits of wine, which, when mixed with sugar, makes the liquor known in France as *l'huile de rose.* Rose vinegar is simply dried petals infused in the best distilled vinegar. Honey of Roses is made by beating up fresh flowers with boiling water, and then mixing them with honey. Conserve of Roses is prepared by beating up the petals with their weight of sugar; it was once much used as a medicine, and still enters into the composition of electuaries and other compounds, to which it imparts fragrance.

Strawberry (*Fragaria vesca* and *F. elatior*). These are the wild Strawberries of this country, and were the only ones known in early times, "Strawberry ripe" being a cry in London four hundred years ago. After the introduction of the Virginian and Chilian varieties, all the fine kinds known have been obtained by careful cultivation and hybridization, many being of very large size. They are extensively cultivated, and during the season vast quantities are brought to the London market. Before the days of railways, they were carried in baskets by women, who came chiefly from Shropshire. These Shropshire girls, as they were called, being generally uniform in dress, it was a curious sight to see twenty or thirty marching in a line with the baskets sitting freely on their heads.

Raspberry (*Rubus Idæus*). A deciduous shrub, native of Britain, most parts of temperate Europe, and Western temperate Asia. The fruit is of two colours, red and white, the latter being called the Dutch. By cultivation they have

been improved in size and flavour. They are well known as a dessert fruit, and large quantities are used for jams, jellies, and cooling drinks; also for raspberry vinegar, wine, and brandy. Like the strawberry, they are quite wholesome, but when over-ripe often contain a maggot.

Bramble or Blackberry (*Rubus fruticosus*). The Bramble is a trailing shrub, with long, rambling, prickly shoots. It is a native of Britain, growing in hedges, woods, and waste places; the fruit is black, and is much eaten by children; it is also used for puddings, tarts, and as a preserve. They are generally considered astringent, and are used in France and England for making, as well as colouring wine. The long rods and twigs are used for fixing thatch, and for other domestic purposes.

There are many other species of *Rubus* of low growth, extending to the limits of vegetable life in the northern hemisphere. The fruit of several, such as Dew-berry (*Rubus cæsius*), Cloud-berry (*R. Chamæmorus*), are used in northern countries for making jams and wines.

Tormentil (*Tormentilla erecta* and *T. officinalis*). Perennial plants, with pretty yellow flowers, natives of this country. They have strong roots, which are powerfully astringent, and are used medicinally as well as for tanning.

Agrimony (*Agrimonia Eupatoria*). A native of this country, and most parts of Europe. It is a powerful astringent, and was formerly in high repute with herb doctors in fevers, &c.

The genus *Spiræa* forms a distinct section of Rosaceæ, consisting of a considerable number of species, both shrubs and herbs, indigenous throughout the Northern temperate hemisphere. They are represented in this country by the well-known Meadow-sweet (*Spiræa Ulmaria*), and the no less beautiful Dropwort (*S. Filipendula*); also the shrubby species, *S. salicifolia*, which is rare.

A number of hardy exotic species have been long known in gardens, and during the last twenty years many have been added from North-west America, Nepal, and Japan, all of which are highly ornamental shrubs.

One of the most remarkable plants said to belong to the Rose family is *Brayera anthelmintica*, a native of Abyssinia. It is a tree with winged leaves, and said to have dicœcious flowers. It is described by Bruce as being one of the most beautiful of Abyssinian trees. The flowers are of great repute as a vermifuge, and are most efficacious in the cure of Tape Worm, a prevalent disease in that country. It probably belongs to some other family than Rosaceæ.

About 20 species of South American trees and shrubs constitute another section, but which probably should be considered a distinct family under the name of *Quillajæ*. They differ from Roses, in having a capsular fruit and winged seeds, and in habit seem more nearly related to the Apple and Plum family.

The species most worthy of notice is *Quillaja saponaria*. A tree, native of Chili, attaining the height of from 50 to 60 feet, having smooth, shining, oval green leaves, about $1\frac{1}{2}$ inches in length, and terminal white flowers. Its bark is called *Quillaja*, or soap-bark, and consists of numerous layers, containing much carbonate of lime, and other mineral matter, which renders it so heavy that it sinks in water. It is in common use in Chili as soap. Some years ago it was introduced into this country and recommended as a substitute for soap, especially for washing printed goods, silks, and delicate coloured fabrics. An extract of it is in great repute for promoting the growth of hair, a preparation having been brought into use and sold by hairdressers under the name of "Quillaja Bark." The chemical action of this extract is very peculiar on gold, silver, and glass, a full account of which is given in the *Journal of the Society of Arts* for 1859.

The Almond and Plum Family.

(Drupaceæ.)

Trees or shrubs, with alternate simple leaves, often having glands on their petioles, and furnished with stipules. Flowers solitary or in umbels or racemes, generally white or pink

and showy. Calyx 5-toothed. Petals 5. Stamens numerous. Pistil 1. Fruit a drupe, with a hard bony seed.

The species of this family, above 100 in number, are, with few exceptions, natives of the North temperate zone. Although they furnish many eatable fruits, yet the wood, leaves, and kernels are highly poisonous, containing the principle of prussic acid. A harmless gum, like gum tragacanth, exudes from the stems of many of them.

Peach and Nectarine (*Amygdalus persica*). As its specific name implies, this tree is supposed to be a native of Persia, and is of high antiquity, having it is believed found its way to Italy about the beginning of the Christian era. It is now grown in all moderately warm countries. It is recorded as being cultivated in England about the middle of the sixteenth century, and, although much grown under glass here as well as in Scotland, it nevertheless ripens its fruit in the open air. There are many kinds of peach, as also of nectarine, which differs from it only in the smoothness of its skin. It is most extensively cultivated in the United States, and during the season peaches are as plentiful in New York as strawberries are in London.

Almond (*Amygdalus communis*). A low growing, spreading tree, native of Western temperate Asia. It seldom exceeds 15 feet in height, but under certain conditions is known to attain double that height. It is widely spread over the south of Europe and North Africa, and appears to have been introduced into England about the same time as the peach. It forms an ornamental shrub in spring, but the summers are not warm enough to bring the fruit to perfection. Although there is only one species, the fruit is nevertheless of two kinds, one being sweet and the other bitter. The Sweet Almond is greatly used for dessert, the part eaten being the two seed lobes (the kernel). They form an extensive article of commerce, large quantities coming from Spain, chiefly from Valencia. The best Jordan almonds come from Malaga, and the bitter from Mogador. None come from the country of the Jordan. An oil is expressed from both bitter and

sweet almonds, from which by distillation an essential oil is obtained, which is one of the most virulent poisons known. It is, however, used in perfumery and for flavouring confectionery; but great care is required in its use. A liquid is also distilled from them, which contains prussic acid, and is highly poisonous, but is used in medicine.

Apricot (*Prunus Armeniaca*). This is supposed to have come from Armenia, in Western Asia, but is now domesticated with the almond and peach in most temperate countries, and appears to have been introduced about the same time. On account of its early flowering, it is an uncertain crop in this country, but is well known as a dessert fruit, and is also made into preserves. In Syria Apricots are dried in large quantities, and exported to Egypt under the name of "Mishmush." They are also pressed together, and rolled out into thin sheets 2 or 3 feet long, and are called "Moon of the Faithful," the appearance of which a traveller likens to a "blacksmith's apron." Both these preparations form a considerable article of food, being a very palatable dish when stewed.

Plum (*Prunus domestica*). The wild plum is supposed to be a native of this country, but the fine sorts have mostly originated in France. A great many kinds are cultivated for dessert; those called Damsons and Prunes are extensively used for preserves, the latter in a dried state coming to this country from Portugal, and from France under the name of Brignoles Prunes.

Sloe, also called Blackthorn (*Prunus spinosa*). A small tree or straggling shrub, common throughout Europe. In this country it is generally found in copses and hedge-rows. Its wood is hard and takes a fine polish, and is in common use for making walking-sticks, handles for tools, &c. The leaves when dried make the best substitute for Chinese tea, and were at one time extensively used in the adulteration of that article. The fruit is harsh and acrid; in Germany and Russia a spirit is distilled from it.

Bullace (*Prunus insititia.*) This grows like the preceding,

but has a larger fruit; there is a white variety sold as damsons.

Gean, or Wild Cherry (*Prunus Avium*). A tree, native of this country, sometimes exceeding 30 feet in height. The wood is valued for making furniture. In Germany a spirit called Kirschwasser is distilled from it.

Cerasus vulgaris is a smaller tree, native of this country. It is believed that from this and the preceding, all the fine sorts of cherries have originated.

Common Cherry Laurel (*Prunus Lauro-cerasus*). This well-known evergreen shrub is a native of Western temperate Asia, and has been known in this country for more than two hundred years. Its fruit and leaves are highly poisonous, containing much prussic acid, and fatal consequences have occurred through the use of its leaves. The leaves also yield a volatile oil that forms the basis of cherry-laurel water, and is used for destroying flies; it is a deadly poison.

The Cocoa Plum Family.

(CHRYSOBALANACEÆ.)

Trees or shrubs, having alternate simple leaves with stipules, and lateral parallel veins. Flowers in panicles, racemes, or umbels. Fruit a drupe.

Fifty or more species constitute this family. They are chiefly natives of tropical Africa and America.

Cocoa Plum (*Chrysobalanus Icaco*). A small tree, native of Jamaica and other West India Islands, producing a small fruit which is made into a preserve, and forms an article of trade.

Gingerbread Plum (*Parinarium macrophyllum*). A small tree, native of Western tropical Africa, having stiff oblong leaves, whitish on the under side, and strongly veined. It produces a fruit the size of a large plum. *P. excelsum*, the Rough-skin, or Grey Plum, as also the Pigeon Plum, *Chrysobalanus ellipticus*, and the Yellow Pigeon Plum, *C. luteus*, are abundant in the markets of Sierra Leone.

Pottery Tree. The genus *Licania* and *Couepia*, consist of a considerable number of handsome tall trees, natives, chiefly, of the forests of Brazil and Guiana, several being remarkable for having a quantity of silex in their bark. The most famous is that called by the Indians, "Caraipe;" by some botanists referred to *Moquilea utilis*, and by others to a species of *Licania*. The bark is very hard and brittle. It is burnt by the Indians and reduced to a powder, which they mix with clay and afterwards make into vessels that stand fire heat. Specimens of the bark, and vessels made from it, are to be seen in the Museum at Kew.

Hirtella silicea. A considerable-sized tree, native of Trinidad. It also contains silex, and is used by the natives for making pottery.

The Bean and Mimosa Family.

(Leguminosæ.)

Trees, shrubs, or herbs, often twining or tendril climbing ampelids. Leaves simple, winged or compound-winged, furnished with stipules, true leaves sometimes absent (as in many *Acacias*). Calyx 5-cleft, unequal. Petals generally 5, equal and regular, or unequal and papilionaceous. Stamens few or generally 10 or more, wholly united or 9 united, and 1 free or all free. Pistil 1, often curved. Fruit, a 1- or many-seeded legume, rarely a 1-seeded drupe.

This is the second largest family of plants in the vegetable kingdom. They are found in all countries favourable to plant life, and probably consist of not less than 7000 species, varying in size from the creeping *Trefoil* to the lofty *Mora* and *Courbaril* trees. They all agree in one important character, of their fruit being what is called a legume or pod, as in the Pea, Bean, and Scarlet-runner. The pod, however, varies very much in form, size, and texture, being cylindrical, convex, angular, flat, straight, crooked or spiral; and thin membranous, leathery, woody, and even pulpy; from less than an inch to several feet in length. The flowers

also vary very considerably, being regular or irregular; a great number are papilionaceous, that is, having a butterfly-like appearance, as in the common pea. The variations of the form and structure of the flower furnish sufficient character for dividing this vast family into three sub-families. 1st. *Papilionaceæ*, Butterfly flowers; 2nd. *Cæsalpinieæ*, Irregular (not papilionaceous) flowers; 3rd. *Mimoseæ*, Flowers with equal small scale-like petals, and long exserted stamens. The first of these contain all the wholesome pulse and fodder plants. About 72 species are described as being natives of Britain.

Pea (*Pisum sativum*). The Garden Pea is supposed to be a native of the South of Europe, at least so far as regards the grey or field pea, from which it is believed that all the varieties of white, blue, marrowfat, and sugar peas have originated. Their uses are well known: split peas are the cotyledons of the white peas, divested of their skins. In Scotland, grey peas are ground into meal, of which bannocks are made, forming very nutritious food.

Bean (*Faba vulgaris*). Like the Pea this is of ancient cultivation, "beans, lentiles, and parched pulse," being part of the provisions furnished to King David, as recorded in the 2nd Book of Samuel. It is supposed to have been first introduced into this country by the Romans. Like the pea, there are several varieties, such as field and broad Windsor Bean.

Scarlet Runner Bean (*Phaseolus multiflorus*). This is believed to be a native of Mexico, and was introduced into this country more than two hundred years ago. It is well known in every garden, being cultivated for its pods, which are used when young as a vegetable. Naturally it is a tuberous perennial, but it is too tender to stand the winters of this climate. The beans, when ripe, are unwholesome, and even in some degree poisonous.

Kidney or French Bean (*Phaseolus vulgaris*). This is probably a native of Western Asia; it appears to have been cultivated in this country about the end of the sixteenth

century. There are several varieties, all of which are cultivated for their pods. The bean called Haricot forms a considerable article of food in France and Italy, and is sometimes used in this country.

Dolichos, or *Vigna sinensis*. A plant extensively cultivated in India for its pods, which are sometimes two feet in length, containing a number of pea-like seeds, called by the Hindoos Chowlee, and forming a considerable article of food. In China the green pods are used as a vegetable. Other species are cultivated, such as *Dolichos uniflorus*, called Black Grain, *D. vulgaris* and *D. cultratus*.

Soy (*Soja hispida*). A small erect trifoliate hairy plant, native of India and China. It is cultivated for its seeds, which are made into the sauce called Soy; they also yield an oil. It is cultivated in France, but this country is too cold for it.

Pigeon Pea (*Cajanus indicus*). A native of India, but now cultivated in most tropical countries. Naturally it is a shrub attaining the height of from 8 to 10 feet, but in cultivation it is treated as an annual. As a pulse plant it forms an important article of food in India, as well as in Jamaica, where a variety is called "No-eye-pea." It is also a fodder plant for cattle.

Lentil (*Ervum Lens*). This is the first special food plant mentioned in the Bible, as we read in Genesis* that "Jacob gave Esau bread and pottage of lentiles;" a previous verse shows this to have been red pottage, therefore made of the variety of red lentils still in cultivation in Egypt and other countries of the East. On the continent they are extensively cultivated, and a considerable quantity is imported to this country. The meal of lentils is very nutritious; a preparation of it with other ingredients forms the invalid food advertised under the names of Ervalenta and Revalenta, those names being anagrams of the botanical name *Ervum Lens*.

* Chap. xxv. ver. 34.

Tare, or Vetch (*Vicia sativa*). A plant similar to the last, but cultivated exclusively as early green fodder for cattle.

Earth Pea, or Ground Nut (*Arachis hypogœa*). The native country of this plant cannot be ascertained with certainty, but it is believed to be America; it has long been extensively cultivated in Africa, the West Indies, and all warm countries. It is an annual, growing from 1 to 2 feet in height, having soft clover-like leaves, and small yellow flowers on long footstalks, which are at first erect, but on the formation of the pod they bend down, and the pod becomes embedded in and ripens in the earth. It is about two inches or more in length, and contains two or three nutty-flavoured peas, which constitute an article of negro food, and are of commercial value for the oil they yield, which is nearly equal to olive oil.

An allied plant, *Voandzeia subterranea*, is also extensively cultivated as an article of food in Western and South Africa, and has become naturalized on the continent of America.

Clover (*Trifolium pratense*). The common red clover has, like many other cultivated plants, assumed several different forms, some almost sufficiently distinct to appear like separate species, known by the names of Zigzag Clover (*T. medium*), Carnation Clover (*T. incarnatum*), and Alsike Clover (*T. hybridum*).

Dutch or White Clover (*Trifolium repens*). This is well known as a fast-spreading plant, being the pioneer to cultivation, superseding all other plants, as is now the case in New Zealand. Its flowers are of great importance for the honey-making bees. It is said to be the shamrock of Ireland, but it is very questionable if it had become naturalized at the time of St. Patrick's landing in that country.

French Honeysuckle (*Hedysarum coronarium*). A beautiful plant, native of Spain and Italy, and cultivated in this country as food for cattle; fields of it, as also of *Trifolium incarnatum*, and of Saintfoin (*Onobrychis sativa*), have a splendid appearance when in flower.

Lucerne or Medick (*Medicago sativa*). A well known

fodder plant. Hop Medick (*M. lupulina*), is also cultivated for fodder; its flowers have some resemblance to those of Hop; hence its name.

Bokhara Clover (*Melilotus alba*). Some years ago this came into repute as a fodder plant, but is now not much used.

Melilot (*Melilotus officinalis*). A clover-like annual or biennial, widely cultivated throughout Europe and Western Asia, as food for cattle. In Switzerland the leaves are made into powder, which is used for flavouring Chapzieger Cheese.

Fenugreek (*Trigonella Fœnum-Græcum*). An annual, growing like Lucerne. It is a native of the South of Europe and of the regions around the Mediterranean. In Greece the seeds are eaten, either boiled or raw, mixed with honey; they are of strong odour, and were used in medicine by the ancients; but now their only use is for giving false importance to horse medicine, and flavour to damaged hay.

Lupin (*Lupinus albus*). An annual, which, according to history, has been cultivated in Egypt from the most remote period. It is extensively grown in the South of Europe for ploughing in as manure (which is also the case in Germany with the Yellow Lupin). For some years past it has been cultivated in many parts of Britain for the same purpose. The seeds of this, also of the well known blue and yellow Lupins, are used as food when boiled; in a raw state they are poisonous, the two latter in a higher degree than the first.

Liquorice (*Glycyrrhiza glabra*). A strong-growing perennial, with winged clover-like leaves. It attains the height of 2 or 3 feet, and is a native of the South of Europe, where it is extensively cultivated, as also in some parts of this country, especially near Pontefract in Yorkshire, and Mitcham and Kew in Surrey. It has a long tap-root, attaining in some soils the depth of 5 or 6 feet, which by boiling yields a molass-like sweet syrup extensively used for giving an apparent body to inferior porter. The well-known Spanish liquorice is the juice hardened and made into rolls, which is imported from Spain.

Senna (*Cassia acutifolia*, *C. elongata*, and others). Slender annuals, about 2 feet high, having winged leaves, which when dry constitute the Senna of the shops. They are cultivated in the regions of the Mediterranean, Egypt, Arabia, and India.

Cassia fistula. A small tree, producing abundance of showy yellow flowers. It is a native of the East Indies, and has been introduced into the West Indies, and other countries. Its pod is cylindrical, about twice the thickness of the finger, 1 to 2 feet in length, and known by the name of Pudding Pipe. The interior is divided into numerous partitions, each containing a seed embedded in black pulp, which forms the laxative medicine called Lenitive Electuary.

Indigo (*Indigofera tinctoria*). A slender branching shrub, with winged leaves, native of and extensively cultivated in India, which, with *I. Anil*, a species of the West Indies, produces the Blue Indigo dye. It is obtained by soaking the stems in water, and after undergoing several processes the deposit when dry is made into cakes.

Crotalaria juncea. This, as well as *C. retusa*, is a slender-stemmed annual, with simple leaves. Both are extensively cultivated in India for their fibre, which is much used for making ropes and bags.

Another fibre is obtained from *Sesbania aculeata*, a much-branched annual, native of India, where in some parts it is cultivated. The fibre is very strong and durable under water. It is also found in the West Indies and Tropical America.

Shola or Solah (*Æchynomene aspera*). A native of India, Malacca, and other parts. It has spongy white stems, 2 to 3 inches in diameter, floating in water, and winged leaves. The stems, on account of their lightness, are united together by pressure, and used for many purposes—such as for making pith hats, floating jackets, and other ornamental articles. The curiosity chips from Japan are made from the pith.

Locust or Carob Tree (*Ceratonia Siliqua*). A small tree, with shining, winged leaves, attaining the height of from 20

to 30 feet. It is a native of most countries bordering on the Mediterranean. The flowers are yellow, and have a very fœtid odour; the pods contain much mucilage of a sweet nature, of which a syrup is made, and are by some supposed to be the "Locusts" that John the Baptist lived upon in the wilderness, the tree being called St. John's Bread. They are also supposed to be the "husks" mentioned in the Parable of the Prodigal Son. The pods have for some years past been imported into this country for feeding cattle, and form part of the patent horse food; they are also sold in shops as sweets for children.

Algaroba. This is the name of the pods of several species of *Prosopis*, which are found to extend from Chili northward to Western Mexico. They are small trees, seldom exceeding 20 or 30 feet in height, very prickly, and generally with contorted branches; often having hooked spines. The wood is hard and extremely durable. *P. dulcis* and *P. horrida* are natives of Peru, where they cover extensive plains. The pods are used as food, but more especially for feeding cattle, being similar to the Locust tree pods of Europe.

Tamarind (*Tamarindus indica*). A moderate-sized tree, native of India, Arabia, and Egypt, and has become indigenous in the West Indies, and other tropical countries. It has winged deciduous leaves, and flat pods, about 4 or 6 inches in length, which contain a sweet pulp well known as preserved tamarind.

Manna (*Alhagi maurorum*). A dwarf, thorny, scrubby plant, native of the deserts of Western Asia. It, with other allied species, produces a kind of manna, which exudes and hardens like drops on the leaves, and is collected by shaking the bushes.

Gum Tragacanth (*Astragalus tragacantha*). A native of the same desert countries as the preceding, and abundant in Mount Lebanon. It is a harsh, spiny, low shrub. A gum exudes from the stem, which is used in the arts as a substitute for glue, and for stiffening crape. The principal supply comes from the Levant.

Gum Arabic (*Acacia vera*, *A. Arabica*). Natives of northern and eastern parts of Africa, Arabia, and the East Indies. They are generally small spiny trees or shrubs, growing in deserts. The gum, of which there are different qualities, exudes from the stem and branches. Gum Senegal is produced by an allied species.

Acacia giraffe, *A. sequale*, or *A. nilotica*, are small thorny trees, similar in habit to the preceding, natives of the deserts of South-Eastern Africa and Arabia. It is supposed that the latter was the "Shittim wood" of which the Ark of the Covenant and the Tabernacle of the Israelites were made.

Cutch (*Acacia Catechu*). A tree, native of India, described as varying considerably in size, being found, it is said, in the Pegu forests from 50 to 60 feet high, and 6 to 8 feet in girth. The wood is cut into pieces and boiled in water, which becomes impregnated with the resin; the water is then strained and evaporated, and the resin dried and made into cakes, in which state it is imported, being used principally for tanning and dyeing. It is also a powerful astringent medicine.

Wattles. A name given by the first settlers of Australia to many species of *Acacia*, with which that country, as well as Tasmania, abounds. They vary in size from scrub, heath, or furze-like, to lofty trees with broad phyllodeæ,* or finely divided compound leaves, all bearing yellow flowers, and presenting a gay appearance, from which circumstance they are favourites in greenhouses. Many of them yield gum in great abundance, which is an extensive article of import to this country; but it is likely to cease, on account of the trees being cut down for bark, which contains tannin. To such an extent is the trade in bark carried, that the trees have nearly disappeared in the South Australian colonies; the species being chiefly *A. floribunda*, *A. decurrens*, and *A. dealbata*. Their timber is also highly valued, especially that of *A. melanoxylon*, which, as its name implies, is of a dark colour, and takes a fine polish, like other black woods of Victoria.

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* See p. 32.

Acacia homalophylla is known by the name of Myal. In the East and West Indies, as well as in tropical America, the genus is represented by large timber trees, and in South Africa by several thorny species, as *A. Caffra*, *A. giraffe*, and others, one being peculiar in having fine red wood.

Acacia Farnesiana. A beautiful species, with compound winged leaves and fragrant yellow flowers. It is a native of Syria, and abounds in the neighbourhood of the Dead Sea, where it is covered with *Loranthus Acaciæ*, which, when in blossom, gives the whole tree the appearance of being in a flame of fire. It has become naturalized in Italy and other parts of Europe, where it is much esteemed on account of its highly odoriferous flowers, which by process of manufacture, impart their odour to fat, constituting what is called Cassie Pomade. The Oil of Cassie, used in perfumery, is obtained by macerating the flowers in olive oil.

The only species of this genus hardy in this country, is *A. Julibrissin*, a native of the Levant, naturalized in the South of Europe, and introduced into this country more than one hundred years ago.

The numerous species of *Acacia* originally belonged to the genus *Mimosa* of Linnæus. The pods of the latter are separated into valves or joints, which fall away, while in *Acacia* the pod is plain. *Mimosa* is, however, still a large genus, consisting of 200 species of trees and shrubs, with compound leaves, many of which are sensitive and collapse when touched or shaken, the Humble Plant (*Mimosa pudica*) and the Sensitive Plant (*M. sensitiva*) being examples.

Their motion, however, differs from that of the Moving Plant (*Desmodium gyrans*), a native of India. This is a slender growing plant in hothouses, attaining the height of 2 feet, having trifoliate leaves, the two side leaflets being small, while the centre one is about 2 inches in length, of elliptical form, and thin texture. The name Moving Plant is given to it on account of the two side leaflets being in constant motion, rising and falling alternately, but not regularly as to time. In a large plant, many may be seen in motion at

one time; their rise and fall may be compared to the railway telegraph signals.

Balsam of Peru (*Myrospermum* (*Myroxylon*) *peruiferum*) Balsam of Tolu (*M. toluiferum* and other species). Small trees with smooth winged leaves like the Ash, natives of Peru and other parts of tropical America, particularly Guatemala, and the west coast of Central America. They yield a highly valued odoriferous Balsam, which is used in medicine and perfumery. *M. frutescens* is a tree similar to the preceding, but with pubescent leaves, native of Trinidad. It also yields a gum, with which the former is frequently adulterated.

Copaiva Balsam (*Copaifera officinalis*). A large hard-wooded tree, native of Brazil, Guiana, and the West India Islands. The Balsam is contained in the wood of the tree, and is obtained by making deep incisions, when it flows out. The trees are sometimes so full of it, that they burst spontaneously. Large quantities come from the upper region of the Amazon. It is floated down in hollow trees like canoes, some containing as much as 2500 gallons. Other species of the genus are stated to produce Balsams.

Gum Kino (*Pterocarpus marsupium*). A large hard-wooded timber tree, native of India, which with *P. erinaceus* of Western Africa, yields a gum. It is obtained by making incisions in the bark, and is imported for tanning and dyeing. A gum Kino is also yielded by *P. Dalbergioides*, a large tree, native of Burmah and the Andaman Islands, where it grows to the diameter of 4 feet. Its wood is hard and similar to mahogany.

Red Sandal Wood (*Pterocarpus santalinus*). A tree, native of India, particularly on the Coromandel coast. Its wood is of a red colour, and is imported to this country as a dye, being similar to Dragon's Blood. The wood is heavy and close grained.

Brazil or Braziletto wood (*Cæsalpinia echinata*). A rugged-growing tree about 20 or 30 feet high, with prickly branches and winged leaves. It is a native of Brazil, and is

imported as Brazil wood; but there is some uncertainty whether it is not some other allied species that produces the wood. It is used by dyers, and for fine cabinet work.

Divi-divi (*Cæsalpinia coriaria*). A tree from 20 to 30 feet high, native of the West Indies and many parts of tropical America. It has tough, leathery seed-pods, which are extensively used for tanning, and are imported to this country for that purpose.

Sappan Wood (*Cæsalpinia Sappan*). A tree, native of India, having hard wood. Imported for dyeing purposes.

Logwood (*Hæmatoxylon Campechianum*). A small tree, from 20 to 30 feet high, with winged leaves consisting of from 3 to 4 small leaflets. It is a native of Campeachy and other parts of Central America, and has become naturalized in Jamaica and other West India islands. It was early introduced for dyeing purposes, and forms a considerable article of import.

Jamaica Ebony (*Brya Ebenus*). A slender tree with winged leaves, attaining the height of 30 feet or more. It is a native of Jamaica, and has hard wood of a greenish-brown colour which takes a good polish; it is sometimes called Green Ebony, and is also known by the name of Cocus Wood.

Camwood or Barwood (*Baphia nitida*). A tree, native of Western Africa, attaining the height of 40 feet or more. It is imported into this country from Sierra Leone, and is much used by calico dyers for its red colour.

Black Wood or Rose Wood of India (*Dalbergia latifolia*). A large tree, native of Western India. It is highly valued for its timber, the finest and most expensive furniture being made of it. *D. nigra*, a native of Brazil, produces the best Rosewood. Several other species of *Dalbergia*, also various trees, natives of different parts of tropical America, are called Rosewood.

Red Sandal Wood (*Adenanthera pavonina*). A large handsome tree, with compound winged leaves, consisting of numerous small leaflets. It is a native of India, and produces

valuable timber, also a red dye, and the red seeds are made into necklaces and bracelets. (This must not be mistaken for the true Sandalwood tree, which see.)

Moreton Bay Chestnut (*Castanospermum australe*). A large timber tree, native of Moreton Bay (now Queensland). It attains the height of from 70 to 100 feet, having glossy winged leaves a foot or more in length, and racemes of showy red and yellow flowers. The pod is of cylindrical form, 6 to 7 inches in length, containing seeds something like chestnuts, which, though tempting to look at, are unpalatable to Europeans.

Mora Tree (*Mora excelsa*). A large tree, attaining the height of from 100 to 150 feet, having glossy winged leaves like the preceding, but larger, the leaflets being elliptical, 3 to 4 inches in length. It is a native of Guiana, and of late years extensive forests of it have been found in Trinidad. Its timber is now extensively imported to this country for ship-building, and is considered superior to oak. The pods are about 1 foot in length, and 3 inches in breadth, containing several convex seeds $3\frac{1}{2}$ inches long, and from 1 to 2 inches thick; but these are exceeded by the seeds of a species from Central America, which are about 6 inches long and $2\frac{1}{2}$ inches thick, and may be considered the largest seed of any exogenous plant.

Locust Tree of the West Indies, or Courbaril (*Hymenæa Courbaril*). A tree, native of tropical America and the West Indies. In Brazil and other parts it grows to an immense size, the diameter of the true stem being from 6 to 9 feet, surrounded by buttresses measuring round the base above 80 feet in circumference; some trees are supposed to be more than a thousand years old. Its timber is hard, and is sometimes imported for ship-building. The pods are hard and woody, 3 to 4 inches in length, and 2 inches in breadth, containing several bean-like seeds embedded in white spongy matter, and were likened by the early Spaniards to the pods of the Locust Tree of Europe. It yields a gum copal that collects in lumps under and amongst the roots of the tree,

and which accounts for the great quantity of copal found in Angola and other parts of Western Africa, where it is dug out of the sandy or marly soil in lumps. As there is but scanty tree vegetation, none of which at the present time is found to produce gum, it is called fossil copal, and is no doubt the produce of some unknown tree that grew there at some remote period.

Gum Copal of Zanzibar is obtained from *Trachylobium Hornemannianum*. A tree allied to the preceding. The gum exudes from the branches, and is, with the former, imported to this country, as Gum Anime, and used for varnishing. It is also found abundantly in a fossil state in the same country where no trees now exist. The beautiful substance called amber, generally thrown up by the sea, is no doubt the produce of some copal trees, which at some remote period became submerged.

Zamang (*Pithecolobium Saman*). A large tree, native of Venezuela, first brought to notice by Humboldt, who says: "In the evening we saw something in the distance which we took for a mountain, but on near approach found it to be a tree, the famous Zamang of the natives." Its head was hemispherical, having a circumference of 526 feet, the total height being 60 feet, and the diameter near the ground 9 feet. The age of the tree is calculated by Humboldt to be the same as that of the Dragon tree of Oratava, but this is very questionable, for according to the rate of growth of young trees or seeds taken from the Venezuelan tree and planted in the Botanic Garden, Trinidad, in 1820, it appears to be a fast growing tree, for in little more than forty years they attained the girth of 15 feet The leaves of the Zamang are compound-winged, the leaflets being about the size of Ash leaflets. Its thick flattish pods about 8 inches in length and 1 in width, contain a sweetish pulp and are in common use for feeding cattle.

Sabicu Timber (*Lysiloma Sabicu*). A large tree, native of Cuba, yielding planks from 4 to 5 feet in width; it is highly valued for ship-building, and has been extensively im-

ported for that purpose. Its hardness and durability were tested by forming of it the stairs of the Great Exhibition in 1851, at the close of which they were found quite perfect.

Tonquin Bean (*Dipterix odorata*). A tree, native of Guiana. It attains the height of 60 to 80 feet, having simple winged leaves, and fruit of an oval form like the almond, containing one seed, about an inch in length. It is the Tonquin Bean used for scenting snuff, and comes to this country principally from Cayenne.

Laburnum (*Cytisus Laburnum*). Scotch Laburnum (*C. alpinum*). These well known ornamental trees are natives of Switzerland and elevated regions of France and South Germany. In this country they attain the height of 20 feet or more. The wood is hard and valued for turnery work; it takes a good polish, like ebony. The seeds are poisonous. A variety or hybrid, *C. Adami*, is remarkable on account of its producing common yellow and dusky red flowers on the same tree, or even on the same branch; as also tufts of the little *C. purpureus*. To account for this morphism forms a puzzle to physiologists.

Sophora Japonica. This tree was introduced from China more than one hundred years ago, and is perfectly hardy, forming a handsome bushy deciduous tree from 30 to 40 feet high, having dark green winged leaves, and a great profusion of racemes of white flowers, which are used in China as a yellow dye for silk. Several fine specimens are still to be seen at Kew, which were planted at the foundation of the Botanic Garden, in 1760.

Locust Tree of North America, or False Acacia (*Robinia Pseud-Acacia*). A tree, native of North America, and has been grown in this country for more than two hundred years. It attains the height of 40 or 50 feet, averaging 2½ feet in diameter. The wood was at one time considered valuable for ship-building, but if now used, it is only for trenails. The roots smell and taste like liquorice, but are poisonous.

Gleditschia triacanthos is also a Locust Tree of North America similar to the last. Old trees in this country have

attained the height of 60 feet. It is remarkable for the trunk being armed with strong forked spines, 3 or 4 inches in length, and of a very formidable appearance.

Gymnocladus canadensis. Another North American tree, attaining the height of 40 feet or more, having thick, stiff, spreading branches, bearing large compound winged deciduous leaves. A specimen at Kew in one hundred years attained the height of about 40 feet.

Judas Tree (*Cercis siliquastrum*). A rude-growing tree, from 20 to 30 feet high, having a spreading head of stiff branches, simple lilac Syringa-like leaves, and pink flowers, which are produced on the old wood and branches of the tree, before the leaves appear, giving it a remarkable appearance in the distance. It is found wild throughout Southern Europe, Western Asia, and even in Japan. The wood is hard, blotchy, and waved, and takes a fine polish. The tree is abundant in Palestine, and has been long introduced into this country. A supposed second species is found in Canada.

Broom (*Spartium scoparius*). A shrub, native of Britain, and throughout Europe. It is well known for its beautiful yellow flowers, and for its numerous uses in domestic economy. In Spain and France it attains the size of a tree, and its wood, which is hard, is highly valued for veneering and cabinet work. The fibre of the bark is very strong, and capable of being used for many purposes.

Spartium monospermum. A plant abundant throughout the desert countries of Syria and Palestine. It is extensively used for making charcoal, and appears to be "the coals of Juniper," referred to in the Psalms.*

Erythrina Corallodendron. Common throughout the West Indies and tropical America, and is, with other species, called Coral Tree from its red seeds, which are made into necklaces, like coral. They are soft wooded, often gouty-stemmed trees, with prickly branches, laurel-like trifoliate leaves, and with long spikes of splendid red flowers.

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* Psalm cxx. ver. 4.

Ormosia dasycarpa. A tree, native of Brazil and other parts of tropical America, also of the West Indies. It has hard red polished seeds, with a black eye, which are used for making necklaces, &c.

Crab's eyes (*Abrus precatorius*). A slender, twining winged-leaved plant, originally a native of the East, but long naturalized in the West Indies and other parts. It has a small pea-like seed similar to, and used for, the same purpose as the preceding.

Guilandina Bonduc and *G. Bonducella.* Climbing, prickly shrubs, found near the coast in most countries within the Tropics. They have a thin-shelled, prickly pod, containing seeds about the size of nuts, of a beautiful yellow and grey colour, so hard that they resist the force of an ordinary hammer, and appear more like pebble stones than seeds. They are also used for bracelets, necklaces, &c.

Ordeal or Calabar Bean (*Physostigma venenatum*). A strong climbing plant, with leaves and flowers similar to the Scarlet Runner or *Dolichos*, but having a permanent woody stem 2 inches in diameter, and of great height. The pods are about 6 or 7 inches in length, and contain several seeds of a kidney shape, about an inch in length, of a dark chocolate brown colour, approaching black; they are highly poisonous. It is a native of Old Calabar, and is there used as a test for witchcraft. It is found to act powerfully in diseases of the eye. It was much imported, but in 1864 the supply was greater than the demand, in consequence of which, at Liverpool, a quantity was thrown away with the sweepings of the ship. The seeds were found and eaten by children, and proved fatal to several.

Cow-itch (*Mucuna pruriens*). This and other allied species, are natives of Tropical countries. It is a climbing plant, like the Scarlet Runner, and takes the name Cow-itch from its broad pod being densely coverered with small hairs, which, on being touched, or even shaken, spread over the body, and produce intolerable itching, well known to many travellers, and to those who incautiously handle the pods, or

even open paper in which they are contained. These hairs are scraped off, mixed with syrup or honey, and used as a vermifuge.

Scimitar Pods (*Entada scandens*). A strong climbing shrub, attaining a great height, native of tropical India and America. It is remarkable for its large hard-wooded flat pods, which are from 4 to 6 or even 8 feet in length, and being curved, resemble a sword or scimitar. They contain round, hard, convex seeds, about 2 inches in diameter, which are formed into snuff-boxes and toys. The seeds are sometimes sold in London under the name of Indian filberts, but are not eatable; they are often carried by the gulph stream to the Western shores of Scotland.

This family is strongly represented in Australia, not only by the Tree Acacia, but also by numerous small shrubs which form the scrub vegetation of the country. Several of them are highly poisonous, especially *Gastrolobium trilobum*, *G. obtusum*, and *G. spinosum*, natives of Western Australia, where, some years ago, before the cause was discovered, they proved fatal to sheep and cattle, and are known as the poison plants. Their pretty blue and yellow flowers led them to become objects of interest in the greenhouses of this country, and for the first half of the present century they formed an important part of the fine Australian collection at Kew.

Wistaria sinensis. A strong growing woody shrub, trailing and twining to a great length or height, forming a stem 1 foot in diameter. It is a native of China and Japan, and was introduced in 1818. On account of its rapid growth and beautiful bunches of light-blue flowers, which are produced in great profusion, it has become a great favourite for covering walls, trellis work, and dwelling-houses. *W. frutescens* is a similar species, native of North America, but is not so handsome.

SPINDLE TREE AND BUCKTHORN ALLIANCE.

The Spindle Tree Family.

(CELASTRACEÆ.)

Small trees, shrubs or climbing ampelids, with alternate simple leaves. Flowers generally small, axillary in umbel-like clusters. Sepals, petals, and stamens 4 or 5 each, seated round the margin of a fleshy disk. (The petals sometimes absent.) Pistils 1 or 4. Fruit a 3- or 5-valved, dry or drupe-like capsule. Seeds as in *Euonymus*, surrounded by a red fleshy arillus.

This is a widely distributed family, consisting of about 300 species, chiefly natives of temperate regions; special virtues are ascribed to them in their different localities. They are of a somewhat poisonous nature. A few are useful as timber trees.

Spindle Tree (*Euonymus europœus*). A small tree or spreading shrub, native of this country, generally found growing in hedges or in margins of woods. The wood is compact, capable of being split as fine as a hair, and is used by watch-makers, being known to them by the name of Dog-wood. It is also used for shoe-pegs, skewers, and the like.

Euonymus atropurpureus. A shrub or small tree, native of North America, where it is known by the name of Burning Bush, its numerous crimson capsules and red arils giving it a bright appearance when seen at a distance. It forms an ornamental shrub in this country.

Celastrus scandens. A trailing and climbing shrub, native of North America. Its fruit is orange-coloured, as is also the aril, and has the appearance of wax, hence its name, Waxwork Shrub. Many species of this genus are natives of the Cape of Good Hope, and are generally hard-wooded scrubby shrubs, *Celastrus pyracanthus* having hard spines 2 to 3 inches in length. *C. cymosus* has showy white flowers, but of a very fœtid odour.

Catha edulis. This is probably the most important plant of the family. It is a shrub 10 feet or more in height, with rusty coloured leaves, not unlike those of the strawberry tree. It is a native of Arabia, where it is extensively cultivated for its leaves, which have properties similar to those of tea and coffee, and have been used by the Arabs as such from time immemorial, under the name of Kat. It forms a considerable article of commerce, being brought from the interior to Aden in bundles 12 or 15 inches long, consisting of about 40 twigs tied together. It is either used in a decoction or chewed, its effects being very stimulating, producing great hilarity of spirits. The quantity brought to Aden alone is nearly three hundred camel loads per year, and it there represents the Paraguay tea of South America.

One of the largest trees of the family is *Elæodendron integrifolia*, a native of the forests of Pegu. It has white-coloured wood, well adapted for cabinet-work, as is also that of *E. australe*, a native of New South Wales.

A small family has been separated from the preceding, under the name of *Staphyleaceæ*, Bladder-nut family. It consists of about 12 species. Small trees or shrubs, with opposite winged leaves, and flowers in terminal racemes. They are all widely dispersed over both hemispheres, *Staphylea pinnata* being a native of England, and *S. trifoliata* of North America. The seeds of Bladder-nut are oily and purgative.

(Brexiaceæ.)

A small family consisting of about 6 species of small, slender, almost unbranched trees, having firm, glossy, long linear, alternate leaves, with entire or spiny margins. Flowers axillary, in umbel clusters, of a greenish colour, and firm in texture. Calyx, petals, and stamens 5 seated on a disk. Pistil simple. Fruit a drupe.

The best known species are *Brexia Madagascarensis*, which varies in its leaves being smooth or spiny, the latter being well known as *B. spinosa*. *Ixerba brexioides* is a small tree,

native of New Zealand, having spiny leaves similar to the preceding. Their uses are unknown.

(CHAILLETIACEÆ.)

This family consists of 20 or more species. Trees with alternate, simple, entire leaves, often white underneath, furnished with stipules. Flowers small, in compact clusters. Stamens 5. Pistil 1. Fruit a dry 1- 2- or 3-celled drupe. They are principally natives of the tropical regions of both hemispheres. The seeds of *Chailletia toxicaria* are said to be poisonous.

The Buckthorn Family.

(RHAMNACEÆ.)

Small trees or shrubs; some heath-like, often spiny, or twining ampelids. Leaves alternate, simple, furnished with stipules. Flowers axillary, small, inconspicuous, generally greenish yellow. Petals 4 or 5, plain or hooded. Stamens 5, and with the petals inserted on a fleshy disk, in which the ovary is partially immersed. Pistil 1. Fruit a berry (drupe-like) or a dry capsule.

This is a widely distributed family, consisting of more than 250 species; represented in North America by the beautiful genus *Ceanothus*, in Europe and Asia by *Rhamnus* and *Zizyphus*, in South Africa by *Phylica* and others, and in Australia by *Pomaderris*. A yellow principle pervades the family.

Buckthorn (*Rhamnus catharticus*). A rude-growing straggling spiny shrub, about 10 or 12 feet high, native of this country. Its fruit is about the size of a currant, of a bluish black colour, and is nauseous and purgative. The juice of the unripe berries is yellow, and is used for staining maps. The juice of the ripe berries is the sap green of painters. It is also called "bladder-green."

Rhamnus infectorius. A native of the South of Europe and Western Asia. The berries are of considerable importance as a dye used by calico printers, and known as Yellow

or Persian Berries. Great quantities are imported from ports of the Black Sea, particularly from Trebizond.

A Chinese dye for dyeing silk has of late years come into notice; it is obtained from the bark of two species of *Rhamnus*, *R. chlorophorus* and *R. utilis*. It comes to Europe in cakes under the name of Chinese green indigo. Living plants of both species have been received, and appear to be sufficiently hardy to live in the open air; they might doubtless be naturalized in the south of England and Ireland.

Rhamnus frangula. A stiff branching shrub 6 or 8 feet high, or sometimes with a single stem, assuming the character of a small tree, native of this country, growing in woods and uncultivated grounds. Its wood is much valued for making the best charcoal used for the manufacture of the finest gunpowder.

Jujube (*Zizyphus vulgaris*). This is extensively spread throughout the South of Europe, North and West Africa, and Western Asia. It is a prickly entangled growing shrub, or, when cultivated, assumes the character of a small tree. The fruit is pulpy and of an oval form, about the size of a plum, which is either preserved or dried, and known as jujubes; they are much used in the countries where it is cultivated. The jujube lozenges are flavoured with this fruit, but are not always genuine.

Zizyphus jujuba. A tree, native of India and China, having fruit similar to the last. It is extensively cultivated in China, and there are said to be as many as 60 varieties, differing in the size and colour of their fruit.

Zizyphus Lotus. A native of North and West Africa. It is a rambling growing shrub with strong hooked spines and a berried fruit of a yellow colour, which is converted into a sort of bread; a drink is also made from it, and with the bread forms a considerable part of the diet of the natives. It is one of the plants supposed to have been the food of the ancient people called Lotophagi. The fruit of *Zizyphus sinensis* is occasionally to be seen in Covent Garden Market, where it is sold as "Japonicas."

Christ's Thorn (*Paliurus aculeatus* and *P. Spina-Christi*). Prickly shrubs, often of a climbing habit, with strong curved prickles, natives of the South of Europe and Western Asia. In Palestine the latter has been observed as a tree 40 feet high.

Cooper's-wood (*Pomaderris apetala*). A moderate sized, erect, branching tree, with elliptical lance-shaped hoary leaves, probably the tallest tree of the family, native of New South Wales. Its wood is hard and is used for many purposes. This and several other species of the genus are showy greenhouse plants.

(Hippocrateaceæ.)

Trees, or climbing shrubs, with opposite, simple leaves, and small deciduous stipules. Flowers inconspicuous, generally axillary. Petals 5. Stamens 3, rarely 5, united, and forming a tube, with a cup-like base. Fruit a 3-winged, 3-celled like samar, drupe, or berry. Nearly 100 species are recorded as belonging to this family, natives chiefly of the tropics, the greater number being found in South America. The genus *Hippocratea* consists of about 30 species of a woody tree-like character, but requiring the support of other trees.

Tontelea pyriformis. A native of Sierra Leone, having a fruit about the size of a Bergamot pear, very rich in flavour.

Kokoona Zeylanica. A tree, from 50 to 60 feet high, native of Ceylon, from the bark of which the Cinghalese make a kind of snuff; an oil is expressed from the seeds.

SAXIFRAGE, HYDRANGEA, AND LYTHRUM ALLIANCE.

The Henna Family.

(Lythraceæ.)

Herbs or small shrubs, the stems and branches generally 4-sided. Leaves simple, opposite, or whorled, rarely alternate. Flowers solitary, axillary, or in terminal spikes, or

racemes. Calyx straight or oblique, generally ribbed. Petals 4, 5, or 6, or wanting. Stamens 8, or more. Fruit a membranous capsule, enclosed in a persistent calyx.

About 300 species constitute this family, which are widely dispersed, being represented in India by the beautiful shrub *Lagerstræmia indica*, a well known plant in the greenhouses of this country; and in Brazil by the equally beautiful shrubby genus *Diplusodon*, none of which have yet been introduced.

Lythrum Salicaria. This is one of our most beautiful British plants, growing on margins of rivers, ponds, and watery places. It attains the height of 2 to 3 feet, terminating in spikes of bluish pink flowers.

Henna or Khenna (*Lawsonia inermis*). A native of Western Asia, Egypt, and African coasts of the Mediterranean. It is a shrub 8 to 10 feet high, having oval lance-shaped leaves, and panicles of white sweet-smelling flowers. It is of ancient repute as a cosmetic, the leaves being powdered and made into a paste, and used in Egypt for colouring the finger nails and the hair and beard, imparting a yellow colour, which is considered to add to beauty; the manes of horses were even coloured with it. This practice has descended from very remote ages, as proved by the evidence of Egyptian mummies. It was also in early repute amongst the Hebrews, being the plant spoken of in the Song of Solomon* under the name of Camphire. In Jamaica it has become naturalized, and is there called Jamaica Mignonette. This plant sometimes becomes spiny, and is known under the names of *L. spinosa* and *L. alba*, but they are now considered to be only one species.

Jarool or Bloodwood (*Lagerstræmia reginæ*). A large timber tree, with blood-red coloured wood. It is a native of the Peninsula and other parts of India and Burmah, and on account of its great durability in water is much used for boat and shipbuilding, and other purposes.

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* Chap. i. ver. 14; and chap. iv. ver. 13.

Tulip-wood (*Physocalymma floribunda*). A small deciduous tree, native of Brazil, having panicles of purplish flowers, which are produced before the leaves. The wood is much esteemed by cabinet-makers, and is imported for inlaying costly furniture.

(STACKHOUSIACEÆ.)

A small family of probably 20 species of herbs, or small frutlets, with simple alternate leaves, and small flowers in terminal spikes or racemes, white or yellow. Stamens 5. Pistils 3 or 5, united at the base. Fruit 3 to 5 winged, or wingless.

They are natives chiefly of Australia. *Stackhousia australis* has yellow flowers, and has been grown at Kew.

The Saxifrage Family.

(SAXIFRAGACEÆ.)

Annuals or perennials, often frutlets, usually growing in tufts; having simple, entire, lobed, or much divided leaves; often moss-like, or rayed from the centre (rosulate). Flower stems simple or branching. Flowers regular. Calyx inferior (or partially superior?) Petals generally 5. Stamens 5 or 10, free. Pistils 2. Fruit a dry 1- or 2-celled horned capsule, containing numerous small seeds.

This family contains above 300 species, natives chiefly of the temperate regions of the northern hemisphere; a few are found in elevated situations within the tropics, and the family is represented in Terra del Fuego and New Zealand by *Donatia*. *Saxifraga flagellaris* is found within the Arctic circle. They possess slightly astringent qualities, which being powerful in *Heuchera americana*, it has received the name of Alum Root. Many of them are favourite garden plants, especially the genus *Saxifraga*, of which there are nearly 100 species in garden collections, varying in habit and character from the broad-leaved *S. crassifolia* to the rosulate *S. pyramidalis* and tufty moss-like *S. Hypnoides*. They are

in general capable of enduring great drought, and are thus well adapted for rockwork. About a dozen are natives of this country, *S. granulata* being a beautiful moist meadow plant, flowering early in spring. The well-known London Pride (*S. umbrosa*) is found in abundance in Ireland. The pendulous or Bear's-ear Saxifrage (*S. sarmentosa*) is a favourite window ornament; it is a native of China, and was introduced about one hundred years ago.

The Australian Pitcher Plant (*Cephalotus follicularis*) is considered by some botanists to be the type of a distinct family called *Cephalotaceæ;* but there is much difference of opinion as to its affinity with other families; there appears good reason for considering it allied to the present. It is a singular little plant, growing in the form of a rosette, not exceeding 3 to 4 inches in diameter, having small, narrow, spathulate leaves, alternate with which are footstalks bearing small pitchers furnished with a lid attached on the inner side, and resembling a saucepan or goblet, the footstalk corresponding to the handle. The flowers are small, and borne on an erect stalk 6 inches or more in height, forming a spike. There is no corolla, but the calyx is coloured and 6-parted, bearing 12 stamens. The fruit has 6 distinct carpels. It is a native of marshy places in King George's Sound, Australia, and was first introduced to the Royal Gardens, Kew, in 1823, but it continues to be a rare plant and is considered a great curiosity.

Another small family, consisting of a few Chilian species called *Francoaceæ*, is also considered to be allied to *Saxifragaceæ*. They consist of low frutlet-stemmed plants, having soft villose, oblong or deeply lobed, almost winged leaves, and straggling, branching flower-stems 2 to 3 feet in length, bearing pretty white or pink flowers. *Francoa ramosa*, *F. appendiculata*, and *F. sonchifolia* were introduced at Kew nearly forty years ago. They are ornamental greenhouse plants.

The Hydrangea Family.

(Hydrangeaceæ.)

Small shrubs, creepers, or adherent climbers. Leaves opposite, entire, or lobed. Flowers in cymes or umbels, the exterior ones, or often the whole, abortive, the calyx becoming a petaloid involucre of a blue or pink colour. True flowers small. Petals 4 or 6, inserted on the calyx. Stamens 3 or more, in two rows. Pistils 2 or 5, free. Fruit a 2- or 5-celled capsule bearing permanent styles.

Of this family about fifty species are known, natives chiefly of China, Japan, and North America. The American species, *Hydrangea quercifolia*, *H. nivea*, and *H. arborescens*, are hardy in this country; as also is *H. Japonica;* but the species that gives fame to the genus is *H. hortensis*, the showy flowers of which are abortive, and consist of 4 or 5 enlarged coloured sepals only. The *Hydrangea* was introduced from China in 1790.

Adamia versicolor is a soft-wooded frutlet with pretty blue flowers, native of Nepaul, as also *Hydrangea altissima*, a species creeping like ivy. Both have been long grown at Kew.

(Cunoniaceæ.)

Trees or shrubs. Leaves opposite, sometimes in whorls, simple or winged, furnished with broad leafy, or small scale-like stipules. Flowers small, in round heads, spikes, or racemes. Petals 4 or 5, or wanting. Stamens 8 to 10, or many, seated on a more or less perigynous disk. Fruit a dry 2-celled closed capsule.

About 100 species constitute this family. They are chiefly natives of Australia, New Zealand, temperate South America, and South Africa; a few are found in India.

The bark of *Weinmannia racemosa*, a tree, native of New Zealand, has been found useful for tanning. About half a dozen species have been introduced, and form ornamental greenhouse plants.

Acrophyllum venosum, a native of New South Wales, is a favourite show plant.

Cunonia capensis, a native of the Cape of Good Hope. A small tree, having winged leaves and large stipules, the whole, as well as the root, being of a reddish colour, the latter smelling like carrots. At the Cape it is known by the name of "Blood Elze."

† † † Stamens hypogynous.

VIOLET, TAMARISK, AND BARBERRY ALLIANCE.

The Sundew Family.

(Droseraceæ.)

Small herbs, rosulate perennials (rarely frutlets). Leaves round or spathulate, entire or divided, fringed with glandular hairs, or the upper portion fringed with cilia, or (as in *Aldrovanda*) with floating appendages. Flowers solitary or in spikes. Sepals 5. Petals 5, each imbricate in the bud. Stamens 5 to 10. Pistils 3 to 5. Fruit a 3- or 5-valved capsule. Seeds numerous.

This pretty family of plants consists probably of nearly 100 species, the greater number belonging to the genus *Drosera* (Sundews). They are found in marshy places throughout warm and temperate regions. In Western Australia several species grow in dry places, while *Aldrovanda vesiculosa*, a native of the South of Europe, floats in water. *Drosera rotundifolia* and *D. longifolia* are the well-known Sundews of this country. The leaves of the Australian species of *Drosera* are entire and almost plain, like primrose leaves, and contain a dye which stains paper red.

Venus's Fly-trap (*Dionœa muscipula*). A remarkable plant, with leaves rising from a centre in the form of a rosette, each leaf consisting of two parts, the lower part being linear and terminated by two distinct lobes about the size of the thumb-nail. The margin of each lobe is fringed with cilia, and the disk is furnished with from 3 to 5 hairs.

On these being touched by an insect, the lobes immediately collapse like a common rat-trap, and remain closed until the insect ceases to move. This action can also be witnessed by touching the hairs with a fine point. It is a very rare plant, being found in a very small area near Wilmington, in South Carolina, United States.

The Tamarisk Family.

(TAMARICACEÆ.)

Shrubs, rarely trees, with rod-like, smooth bay-coloured stems, having twiggy branches closely furnished with small heath-like, alternate leaves. Flowers in spikes or spiked racemes, having a feathery appearance when mature. Calyx persistent. Petals 5. Stamens 5 or 10. Pistils 3. Fruit a 3-valved capsule, with numerous feathered seeds.

About 40 species are enumerated of this family. They are chiefly natives of Middle and Southern Europe, North Africa, Northern Asia, and India, generally near the coast.

Tamarix gallica. A common and beautiful shrub, native of this country, especially of Cornwall, Hampshire, and Kent, to the shores of which counties it is an ornament. Few plants are more widely distributed than this, being found on the coasts of the Atlantic and the Mediterranean, in Western Asia, Himalayas, Tartary, and Japan. In Tartary sheep are fed on the tops of the dwarf plants. Its ashes contain a quantity of sulphate of soda.

Tamarix, or, as now called, *Myricaria germanica*, is a shrub similar to the last, but differing in the flowers having 10 stamens. It is common throughout Germany and many other parts of Europe.

Manna (*Tamarix mannifera*). A shrub, similar in habit to the preceding, native of Syria and the wilderness of the Israelites about Mount Sinai. The stem is punctured by an insect, when a juice exudes which hardens, and is collected and made into cakes that receive the name of Manna. It consists of a mucilaginous sugar, and forms an article of

commerce with the Bedouin Arabs, who preserve it in bottles and use it in the same manner as honey. It is by some supposed to be the manna of Scripture, but does not agree with the description given of that substance. (See Manna, page 107).

Salt Tree (*Tamarix orientalis*). A native of Western India. It is a most remarkable tree, and of rapid growth. Trees, six or seven years of age, measure 5 feet in girth, and fall in twenty years from old age. It contains much salt, with which the tree becomes encrusted, and is used by the natives to season their food. The wood when burned has a very offensive odour.

The Sea-Heath Family.

(FRANKENIACEÆ.)

Herbs, shrubs, or small frutlets. Leaves opposite, with a membranous sheathing base. Flowers solitary, sessile, and closely surrounded with leaves, generally pink. Sepals 4 or 5, united in a tube. Petals 4 or 5, often with a nectary appendage. Stamens 4 to 6, or more. Pistils 1- 2- or 3-parted. Fruit a 1-celled valve capsule, enclosed within the calyx.

This family consists of above 20 species, all widely distributed over Europe, North Africa, and Australia. *Frankenia pulverulenta* and *F. lævis*, both trailing plants, are found on the sea-shores in Britain. *F. pauciflora*, a pretty greenhouse frutlet, native of New South Wales, has been long cultivated at Kew. *Beatsonia portulacifolia*, an erect stiff shrub, is found only in the island of St. Helena, but is now believed to be extinct.

In alliance with *Frankeniaceæ* is a small family called *Vivianiaceæ*, consisting of a dozen or more species of herbs or slender frutlets, with hoary leaves and pretty pink and white flowers. They are natives of Chili. *Viviania cristata* has been introduced at Kew.

The Porewort Family.

(Tremandraceæ.)

Small twiggy shrubs, with heath-like, alternate, or whorled leaves, furnished with glandular hairs. Flowers solitary, pink, or purple, showy, consisting of 4 or 5 equal involute petals. Stamens 8 or 10, 2 to each petal. Anthers opening by a pore. Fruit capsular.

This family consists of about 20 species, belonging chiefly to the genera *Tremandra* and *Tetratheca*. They are natives of Australia. Several species have been introduced, and form ornamental greenhouse plants. Besides being heath-like in habit, they also agree with the Heath family in the anthers opening by a pore, but their polypetalous flowers separate them from that alliance.

The Violet Family.

(Violaceæ.)

Herbs, small shrubs, soft frutlets, or large trees. Leaves alternate, rarely opposite, simple, entire, or lobed, with stipules. Flowers solitary, on long footstalks, or several together. Petals 5, equal or unequal, 1 generally spurred. Stamens 5, often with a gland at their base. Fruit a 3-valved capsule, with numerous seeds, fleshy, drupe-like, or berried.

This family comprises about 300 species, the principal being natives of Europe, Northern Asia, and North America. These are wholly herbaceous, while others, natives of tropical America, consist of pretty shrubs and trees.

Seven species of *Viola* are natives of Britain, the most conspicuous of which is *V. odorata*, growing on banks and in shady hedgerows, its pretty blue flowers perfuming the air. Vast quantities of these are collected in the spring, and sold in all large towns. The garden double variety is most highly prized, especially the Neapolitan, which forms a frutlet stem 6 inches in height, and is called the tree violet.

Heartsease or Pansy (*Viola tricolor*). An annual, also a native of Britain. In its wild state it has small white or yellowish flowers, but by cultivation many varieties have been raised of large size and singular beauty, known under the name of Pansies.

Ionidium Ipecacuanha. A shrub, native of Brazil, the root of which, with that of other species, is used for ipecacuanha.

Schweiggeria pauciflora. A small Brazilian shrub, long introduced at Kew, and is interesting in having pretty white violet-shaped flowers.

Hymenanthera dentata. A strong growing shrub, or rather small tree, native of New South Wales. It grows freely in the greenhouse, producing abundance of pendulous green flowers.

Leonia glycycarpa. A tree, native of Peru, having alternate, oblong, firm leaves, and loose panicles of yellow flowers. Its fruit is about the size of a peach, having a rough, netted skin, and containing a sweet pulp, which is eaten by the natives.

In alliance with *Violaceæ* is the small family *Sauvagesiaceæ*, consisting of from 15 to 20 known species, principally natives of tropical America and the Malayan Islands. They are small annual or perennial herbs or shrubs, having alternate feathery-veined leaves with fringed stipules, and pretty white, pink, blue, or yellow flowers in terminal panicles or racemes, or solitary. In Brazil *Sauvagesia erecta* is called the herb of St. Martin, and is used medicinally.

Luxemburgia ciliosa is a small neat shrub, with oblong elliptical fringed leaves, and pretty yellow flowers. It has been cultivated in this country; some botanists place it in Ochnaceæ, which seems a natural position for it.

Great differences of opinion exist as to the relationship of the pretty plant, Grass of Parnassus, *Parnassia palustris*, some placing it with Sundews, Saxifrages, and St. John's Worts; but an eminent botanist has lately shown it to be more naturally connected with this family.

The Gum Seed Family.

(PITTOSPORACEÆ.)

Small trees or shrubs, sometimes spiny; or climbers, with alternate simple leaves. Flowers bell-like, solitary, or several together, axillary, or terminal, blue or white. Petals sometimes partially united. Fruit a valved capsule, containing seeds embedded in gum; or a round or oblong pulpy berry; or flat and partially winged, with two seeds.

Nearly 100 species constitute this family. They are chiefly natives of Australia and New Zealand, also of China and other widely separated localities, but are not known in America. They present two distinct habits of growth. *Pittosporum*, consisting of trees and shrubs, with sweet-smelling flowers, like Lily of the Valley. *P. Tobira*, native of China, a shining leaved shrub, has been known to stand several years in the open air of this country. *P. undulatum* is a tree, native of New South Wales, where it grows from 70 to 80 feet in height; its wood is similar to Box. In the Azores it is extensively planted to shelter the orange plantations. *Billardiera*, *Sollya*, and their allies are slender twining plants, usually with pretty blue flowers, natives of Australia, and well known as ornamental plants in greenhouses.

The Barberry Family.

(BERBERIDACEÆ.)

Evergreen or deciduous shrubs, rarely trailing; generally with prickly stems and leaves; or perennial, with running or tuberous roots. Leaves simple or variously compound, alternate; footstalks somewhat sheathing at their base. Flowers solitary, in panicles or racemes. Petals 4, 5, or 6, with gland-like appendages at their base. Stamens 4, 5, 6, or 9. Pistil, generally short. Fruit an oblong or round pulpy berry, or capsule, containing one or more seeds.

About 100 species are known of this family. They are natives of the cooler regions of the temperate zone, also of the southern parts of South America, but none are found in

South Africa, Australia, or Islands of the Pacific. They have astringent properties.

Barberry (*Berberis vulgaris*). A deciduous shrub, native of Britain and most parts of Europe and of North America, growing to the height of 7 or 8 feet. It is found in dry places, in woods, coppices, and hedges. The pretty bunches of red fruit are well known, and form a pleasant acid preserve; the unripe ones are pickled as a substitute for capers. The bark is of a yellow colour, very astringent, and is used for dyeing and tanning leather. The fruits of the allied Indian species are dried in the sun like raisins. The Barberry is extremely subject to a mildew fungus called *Æcidium Berberidis*, at one time supposed to be the cause of rust in wheat, which led to its extirpation from hedgerows. But the microscopical examinations of Bauer proved the Barberry and wheat funguses to be two distinct species.* The section with pinnate leaves called *Mahonia*, consists of several species, natives of North Western America, which are ornamental plants in the shrubberies of this country, and in many places are planted as shelter for game. *Berberis Fortunei* and *B. Bealei*, are natives of China, and differ from the preceding in having single stems and winged leaves, forming small erect trees.

Nandina domestica. An erect single-stemmed shrub, like a small tree, bearing tufts of compound leaves on its apex, terminated with panicles of flowers, followed by red berries like those of holly. It is a native of China, and at the season in the Chinese religion answering to our Christmas, it is used for decorating houses and altars in temples, and bears the name of Sacred Bamboo.

In 1862 a plant was introduced under the name of *Berberidopsis corallina*, native of Valdivia, in Chili. It is of scandent habit, having simple leaves and pendulous racemes of red flowers, which, as well as the trailing stem and fruit, seem to unite the family *Lardizabalaceæ* with that of *Berberidaceæ*.

* More recent investigations tend to revive the original idea that they are different forms of the same species.

The genus *Epimedium* consists of pretty, low herbaceous plants, 6 to 12 inches high, natives of Europe, Northern Asia, and Japan.

Several species are cultivated in botanic gardens. *E. alpinum*, called Barrenwort, is considered a native of this country, but it is rare.

The Indian Plum Family.

(FLACOURTIACEÆ.)

Shrubs or small trees, sometimes spiny, with alternate, entire, or toothed leaves. Flowers small, axillary, solitary, or in small umbels, some unisexual. Petals 4 to 5 or more, or absent. Stamens 6 to 10, or very numerous. Fruit capsular, 1-celled, indehiscent or valved, sometimes fleshy and pulpy. Seeds numerous.

Above 80 species represent this family, all being widely distributed throughout the tropics, but sparingly represented in South Africa and New Zealand.

Indian Plum (*Flacourtia cataphracta*, and *F. Ramontchi*). Small trees, natives of Madagascar and India. The fruit of the latter is about the size of a plum, of a sharp but sweetish taste. *F. sepiaria*, a stiff spiny bush, is in common use in India for forming hedges.

Arnatto (*Bixa Orellana*). A small tree, originally native of South America, but now widely dispersed throughout the tropical regions. It has round cordate leaves, similar to, but larger than, those of the lime tree. The fruit consists of a flat roundish pod, which, when ripe, is covered with bristles of a reddish brown colour, and contains numerous seeds enclosed in an orange-red waxy pulp, which hardens when dry, and is the dye called Arnatto. It is separated from the seeds by steeping them in water, after which it is dried and made into rolls and cakes. It forms a considerable article of commerce, and the Indians of Guiana and other parts of tropical America paint their bodies with it. In this country it is used by silk-dyers and varnish-makers, also for colouring cheese, chocolate, and adulterated milk.

The fruit of *Aberia caffra*, called Kei Apple, a native of Natal, makes an excellent preserve. The pulp of the fruit of *Oncoba spinosa*, also a native of Natal, is likewise eaten, and the hard shell is made into ornamental snuff-boxes.

(Olacaceæ.)

Trees or shrubs. Leaves simple, alternate, entire. Flowers small, axillary, in heads or short racemes. Petals 4 to 6, free, or united in pairs. Stamens free, or variously united to each other. Fruit drupe-like, one-celled, one-seeded, often surrounded by an enlarged fleshy calyx.

A small family, of about 50 species, all widely distributed within or near the tropics, both in the Old and New World. The principal and best known genera are *Olax*, *Heisteria*, and *Ximenia*. The fleshy fruits of some are eaten by the natives, but in general they are austere; the wood of *Olax Zeylanica* has a very fœtid odour, and in Ceylon is supposed to be efficacious in fevers.

RUE, QUASSIA, AND BEAN CAPER ALLIANCE.

The Rue Family.

(Rutaceæ.)

Trees or shrubs, rarely herbs. Leaves broad or heath-like, alternate, simple, or winged, full of aromatic resinous cells. Flowers solitary, or in spikes, panicles, or racemes. Petals 4 or 5, or their bases united, forming a ring or tube. Stamens free, or united in a tube, partially perigynous. Fruit a dry valvular capsule, single, or several united, each cell containing 1 or 2 crustaceous seeds.

An extensive family, consisting of above 400 species, all widely distributed, many being pretty flowering shrubs, natives of South Africa and Australia; in tropical America and India the family is represented by lofty trees, and in Europe by the herbaceous genus *Fraxinella*.

Rue (*Ruta graveolens*). This well-known shrub is a native of the South of Europe, Western Asia, and Palestine.

It was held in high favour as a medicinal plant by the ancients, being for many ages considered a preventive of contagion, and was called the herb of grace. It has been long cultivated in gardens, and is still often used as a domestic medicine in the form of tea; its repute is due perhaps to its possessing a strong odour rather than to any active medicinal principle it contains. It is also used by spirit dealers to impart false flavour to spirits.

Buku (*Diosma crenulata*). This, and other allied species are neat little shrubs, natives of the Cape of Good Hope. They have small crenated leaves, full of oil-cells, having a strong fragrant odour, and are imported for medicinal purposes. The Hottentots make a powder of the leaves, which they mix with grease, and then daub their bodies, this constituting an important part of their toilet; Buku steeped in brandy, is also a favourite with them in all complaints.

Angostura Bark (*Galipea officinalis*, or *G. Cusparia*). A native of North Brazil and Guiana. It is a tall tree with trifoliate leaves, its bark being the true Angostura Bark, the virtues of which are said to be equal to quinine. Angostura Bark Bitters are highly esteemed in the United States.

Cape Chestnut (*Calodendron capense*). A beautiful tree, native of the Cape of Good Hope, having broad elliptical leaves, and showy white flowers, followed by round prickly fruit about the size of a walnut, containing shiny black seeds, not unlike imperfect sweet chestnuts. It was introduced into this country in 1789; a plant at Kew attained the height of 25 feet, with a diameter of 5 inches.

Cyminosma oblongifolia. A tree with simple, oblong, dotted leaves, is, according to A. Cunningham, one of the Yellow woods of Moreton Bay.

Fraxinella (*Dictamnus Fraxinella* and *D. alba*). Well-known showy plants, natives of the South of Europe and Western Asia. The whole of the plant is covered with glandular dots of strong aromatic odour, said to emit a volatile oil, which impregnates the air to that extent that on a light being held close to the plant it is followed by a flash, and

many people, who wish to account for everything naturally, call it the Burning Bush of Moses. The writer has, however, tried the experiment, but has never succeeded in seeing the flash.

Many of this family are favourites in the greenhouses of this country, such as the genera *Boronia*, *Correa*, and *Eriostemon* of Australia, and *Diosma* of South Africa.

The Quassia Family.

(SIMARUBACEÆ.)

Large trees or shrubs with winged, rarely simple, leaves. Flowers in spikes or racemes, some unisexual. Sepals and petals 4 or 5 each. Stamens 4 to 10. Pistil 1. Fruit a single 1-seeded drupe, or several seated round a receptacle, forming a compound fleshy fruit.

About 50 species compose this family. They are natives chiefly of India, Java, and tropical America. The whole are bitter and tonic, many being used medicinally in their native countries.

Quassia (*Quassia amara*). A small tree, native of Surinam and Guiana, and now cultivated in the West Indies. It has winged leaves, and spikes of red flowers; its wood was at one time largely imported to this country, and on account of its bitterness was used as a substitute for hops, but has now been superseded by the bitter wood of Jamaica, *Picrasma* or *Picræna excelsa*, the Quassia wood of the shops, which is so bitter that cups made of it impart bitterness to water allowed to remain some time in them; hence the "Bitter Cup." An infusion of Quassia chips is found destructive to flies. It was once in high repute for its efficacy in fevers, but is now seldom used.

Simaruba Bark (*Simaruba amara*). A tree, native of the West Indies and Guiana, attaining the height of 20 feet. It has crooked branches; the bark is extremely bitter, and is used in the form of a decoction for many complaints.

Cedron (*Simaba Cedron*). A remarkable tree, native of New Grenada and Darien, and other parts of Central America. It is of erect growth, not much disposed to branch, and has winged leaves like the Ash. The fruit, which is covered with short downy hairs, is about as large as a swan's egg, and has the appearance of an unripe peach. It contains a single seed, which easily separates into two fleshy cotyledons, about an inch in length and of a whitish colour. It has been long known as a bitter tonic, and is said to be a certain cure for the bites of snakes and other noxious animals; it is highly valued in cases of fever. It was first brought into notice by the Buccaneers about the end of the seventeenth century, and is one of the few plants that still retain their medicinal reputation. It is now cultivated in Trinidad, and its seed forms an article of commerce.

Ailanto (*Ailantus glandulosa*). A large tree, native of China, which in this country attains the height of 60 or 70 feet, having a large head of branches and winged leaves, like the Ash. In France it is much planted as an avenue tree, and has lately come into reputation for feeding a new kind of silkworm, which, experiments show, might be turned to account in this country. The wood has a beautiful yellow grain and is used by cabinet-makers.

The Yellow-wood Family.

(Xanthoxylaceæ.)

Trees or shrubs, often with prickly stems, having alternate or opposite, simple or winged, leaves, with pellucid oil-cells. Flowers small, inconspicuous, some unisexual. Fruit a berry or a winged samar containing 1 or 2 seeds.

About 100 species are enumerated of this family. They are widely distributed over tropical and temperate regions, the greater number being found in America. They all possess an aromatic and pungent property, and in some countries are called Peppers.

Toothache tree (*Xanthoxylon fraxineum*). A small tree with pinnate leaves, native of North America; it lives in the open air in this country. Its bark is famed for the cure of toothache.

Xanthoxylon clava-Herculis. A native of the West Indies; it furnishes the black prickly walking-sticks often seen. *X. piperita*, the Pepper Tree of Japan, has berries about the size of black pepper, which are used as such in Japan. Both have been introduced into this country, but they are not sufficiently hardy to bear the climate.

The Bean-caper Family.

(ZYGOPHYLLACEÆ.)

Trees, shrubs, or herbs. Leaves opposite, firm or soft, once or twice winged, consisting of one or more pairs of leaflets. Flowers solitary or in racemes. Petals 4 or 5. Stamens varying in number from 4 to 12, their base dilated. Fruit a dry or fleshy capsule, 4 or 5 angled or winged.

This family consists of 100 or more species widely distributed in temperate and tropical countries; in some places forming extensive tracts of desert scrub.

Lignum-vitæ (*Guaiacum officinale*). A small tree, rising to the height of 20 or 30 feet, having a round head of stiff branches, and conjugate winged leaves, the whole of a yellowish tinge, and producing clusters of pretty blue flowers like *Hepatica*. It is a native of Jamaica and other West India Islands, and of parts of tropical America. Its wood is extremely hard, and contains a resin known as Gum Guaiacum, which has long been in use as a medicine. The wood, although of small size, is of great importance, and is extensively used in the dockyards, its hardness making it well suited for pulleys and the bearings of steam machinery.

Bean-caper (*Zygophyllum Fabago*). A desert plant, 2 to 3 feet high, native of Syria, Egypt, and North Africa. It is a soft-leaved shrub, having the leaves in pairs. Its flower

buds are used as a substitute for Capers. *Z. album*, a shrubby species, native of the Canary Islands, is grown in the greenhouses of this country.

Honey-flower (*Melianthus major*). A straggling soft wooded shrub with large pinnate-toothed glaucous leaves, having a strong Pea-meal smell. It is a native of the Cape of Good Hope, and grows and flowers well in the greenhouse, or even in the open air of this country when protected in winter. The flowers are of a dark brown colour, in long erect racemes, a foot or more in length, containing a large quantity of honey, which is collected by the natives of the Cape colony.

Caltrops (*Tribulus terrestris*). A trailing spreading annual, with soft succulent leaves, native of Southern Europe, having hard capsular fruit, the valves of which are furnished with stiff spines which stand erect.

Larrea mexicana. A shrub, 4 to 6 feet high, very abundant in some parts of Mexico, forming a dense scrub, particularly on the Colorado desert. It grows in the most sterile sandy soil. Its strong creasote odour renders it disagreeable to travellers, as also to animals. It is unfit for firewood, as it can scarcely be made to burn, its only apparent use being to fix the desert sands.

Balanites ægyptiaca. A scrubby thorny bush or small tree, having leaves growing in pairs. It is common throughout the deserts of Western Asia, Egypt, and many parts of North and Western Africa, where the fruit, which is the size of a walnut, is sometimes eaten, and from which an intoxicating drink is made by the natives. Its wood is hard, and is used by the turners of Jerusalem for making walking-sticks. An oil of a healing nature is obtained from the nuts, and as it grows abundantly in the valley of the Dead Sea, it is supposed to be one of the plants that produced the "Balm of Gilead."

(OCHNACEÆ.)

Small trees or shrubs, with simple alternate toothed leaves. Flowers solitary or in racemes, their petioles jointed. Petals

generally 5 or 10. Stamens 5 to 10, or many, seated on a hypogynous fleshy disk. Pistils several, united in 1. Fruit consisting of several seeded carpels, articulated to a fleshy base.

This family consists of about 100 species, widely spread over all warm regions; they contain a bitter principle. Species of *Gomphia* and *Ochna* are neat leaved shrubs with yellow flowers, several of which have been introduced.

Coriarieæ.

Small trees or shrubs, with erect or decumbent branches, and simple, opposite, smooth leaves, generally longitudinally veined. Flowers small, in long axillary racemes, some unisexual. Fruit, berries formed of the fleshy gland-like petals, enclosing 5 united ovaries, each containing a single seed.

Not more than 4 species constitute this family. On account of some peculiarity in the character of the flower as well as in habit, it is difficult to determine the nearest alliance of this family, but most botanists place it near the Rue Family.

Coriaria myrtifolia. An erect shrub, with myrtle-like leaves, native of the South of Europe. It has received the name of *Coriaria*, meaning leather, on account of its being used in tanning. Its fruit is highly poisonous, fatal effects having occurred to soldiers in Spain through eating it. It is hardy in this country.

Coriaria nepalensis. A more spreading species than the preceding, native of Nepal, where its fruit, which is not unwholesome, is said to be eaten.

Coriaria ruscifolia, known in gardens by the name of *C. sarmentosa.* A native of New Zealand. It is a shrub from 10 to 15 feet high, assuming the character of a small tree, having a stem 6 inches or more in diameter. It occupies large tracts of land, its presence indicating good soil. The fruit consists of a small black, shining, pulpy berry, from which a refreshing wine is made by the natives. The

seeds are poisonous, and eating them has proved fatal in several instances, the action being similar to that of Strychnine, but not so rapid. It is called "Tutu" by the natives.

C. thymifolia, also a native of New Zealand, and probably only a variety of the preceding. Both are also natives of Chili, but are not hardy in this country.

ORANGE AND MYRRH ALLIANCE.

The Orange Family.

(AURANTIACEÆ.)

Evergreen trees or shrubs, sometimes climbing and spiny, simple or winged leaves, generally jointed with the footstalks, and fragrant, being full of oil-cells. Flowers solitary, or in spiked racemes, generally white. Petals 3 to 5, free or partially united. Stamens 5 to 10 or more, free or united in one or more separate parcels. Fruit a pulpy berry, small and 1-seeded, or large, fleshy, and many-seeded, as in the orange.

About 100 species are known of this family, the greater number being natives chiefly of India and other warm countries of the East, extending to China; very few of America. In Florida thousands of acres are said to be occupied by the wild orange, which is believed to have been early introduced from Europe. All contain a volatile aromatic oil.

Citron (*Citrus medica*). A thorny, much-branched tree, about 8 or 10 feet high, having pale green leaves, and an oblong fruit 5 or 6 inches long, with a rough yellowish rind. It takes the name Medica from the country of the Medes, where it is described by Theophrastus as having been cultivated three hundred years before the Christian era; it was also cultivated by the Jews after their return from captivity in Babylon. It is believed to have been introduced from Palestine into Italy by the Romans. The oil of citron is obtained from it.

Lemon (*Citrus Limonum*). The Lemon is found wild in

Northern India, and is supposed to have migrated westward in early times. It was introduced into the South of Europe during the Crusades.

Lime (*Citrus Limetta*). This and the preceding are similar to the Citron, differing only in the form of their fruit, and it is very questionable if they are distinct species. The fruit of this is somewhat oval, with a depression at the top. With the lemon it affords the Lime juice, useful as an antiscorbutic, and now extensively used on long sea voyages.

Seville or Bitter Orange (*Citrus Bigaradia*). This has a bitter rind, which forms the principal Candied Orange-peel of the shops; it also yields a bitter tincture. Our greatest import comes from Spain.

Shaddock (*Citrus decumana*). Said to be a native of China, and now extensively cultivated in Jamaica and other West India Islands. It bears a large fruit, sometimes nearly 2 feet in circumference, called Pompoleon, or more generally Pomaloe; the smaller ones are called Forbidden Fruit, and are known by these names in the London fruit-shops.

Sweet Orange (*Citrus Aurantium*). Found wild in India, but was early cultivated in Persia, and in course of time extended westward to the Mediterranean, thence to Italy, it is said about the eleventh century. Like other plants long cultivated by man, many varieties have sprung up, such as the Blood or Malta Orange, which has a small fruit with red rind and flesh. The Mandarin is also a small, rather flat fruit, having a thin rind, which, when ripe, readily separates from the pulp. It is very rich and sweet, and is extensively grown and highly prized in China. The Bergamot is a small-fruited orange, from which an essence is obtained, called Bergamot Oil.

There are several others, such as the Finger Orange, but they are grown more for curiosity.

The Orange, Lemon, and their principal varieties, form a considerable article of commerce, the great supply to this country coming from Malta and other parts of the Medi-

terranean, Lisbon, and the Azores; the Island of St. Michael's produces very fine oranges.

Oranges for export are gathered before they are perfectly ripe, and on that account the true flavour is not known to those who eat them in this country. In France, and other parts, orange trees are much cultivated for the sake of their flowers, from which are distilled Orange Flower-water, Oil of Neroli, and Napha water.

An immense quantity of Seville Oranges are used in making marmalade, and of the common or Sweet Orange for making wine.

Kumquat (*Citrus Japonica*). A native of Japan and China. In Chusan it occupies extensive slopes of hills, bearing abundance of yellow fruit, which, when ripe, presents a very grand appearance. The fruit is preserved in jars, and forms an important article of export. The plant has been recently introduced into this country, but is too tender for the open air.

Orange sticks are now largely used for walking-sticks; and the wood, which is of a yellow colour, is used for inlaying.

Bael or Bhel Fruit (*Ægle marmelos*). A large tree, native of Coromandel and other parts of India, producing a fruit about the size of an orange, having a hard shell containing 10 to 15 cells, filled with tenacious transparent gluten which is delicious and fragrant; it is used as an aperient, and in other ways medicinally, and is much esteemed.

The fruit of *Feronia elephantum* is the wood-apple or elephant's-apple of India, the pulp of which is eaten by the natives.

The Myrrh Family.

(Amyridaceæ.)

Trees or shrubs, with simple, ternate, or winged leaves, generally with pellucid aromatic oil-cells. Flowers in panicles or racemes, generally small, inconspicuous. Fruit dry and hard, sometimes splitting into valves. Fifty or

more species represent this family, which are almost entirely tropical. They contain resinous balsamic juices, which constitute important drugs.

Myrrh (*Balsamodendron Myrrha*. *B. Kataf*, and *B. Opobalsamum*). Small, rude-growing trees, natives of Arabia. The first two yield Myrrh, and the last, wrongly called Balm of Gilead, or Balm of Mecca, is known as *Opobalsamum*.

Balsomadendron Roxburghii. A native of India, especially of Scinde and the western districts. It yields a resin called "Gogul."

Balsamodendron Africanum, a native of Eastern Africa, yields what is called African Bdellium.

These balsam-yielding plants are natives of dry rocky places, some growing in limestone. The balsams are obtained by making incisions in the stems, from which the juice in some is collected as it flows, while in others it is allowed to harden on the trees. Some uncertainty prevails regarding the Arabian and African plants producing these balsams, which is increased through the product of one country being sent to another before export to Europe; Bombay is a central port of shipment.

Olibanum (*Boswellia thurifera*, by some called *B. serrata*). A lofty tree, native of Central India, having the foliage crowded at the extremity of the branches. It produces the Olibanum of commerce, which is obtained by incisions made in the bark, when the juice exudes and becomes hardened in transparent masses. When heated it is highly fragrant, and is used in Greek and Roman Catholic churches under the name of frankincense.*

In America the family is represented by large trees of *Icica*. *I. altissima*, a native of Guiana, attains the height

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* Since the above was written, a very elaborate paper on the balsam-yielding species of this family has been published by Dr. Birdwood in the Linnæan Society's Transactions.

of 100 feet, and a diameter of 4 or 5 feet. Its wood is light and hard, and is greatly used in making household furniture. The gum called Elemi is the produce of one or more species of *Amyris*, also of *Canarium commune* and other plants, as will be seen below.

Jamaica Birch (*Bursera gummifera*). A lofty tree, native of Jamaica, having brown bark like the Birch Tree of Europe. The fruit yields a balsamic turpentine, and on wounding the bark, a white liquor is obtained, which soon hardens, and is in no way different from Gum Elemi. *Elaphrium tomentosum* and *E. elemiferum*, natives of Mexico, also produce Gum Elemi.

From one of those, or a species of *Bursera*, native of Mexico, is obtained a new perfume, which has lately come before the public under the name of "Lign Aloes," but it has no connexion with the Lign Aloes of Scripture.

The Bead Tree Family.

(Meliaceæ.)

Trees or shrubs, with alternate, or sometimes opposite, simple, or compound winged leaves. Flowers in panicles or racemes. Petals 4 or 5. Stamens 8 to 10, united, forming a long tube. Fruit a hard berry, drupe-like, or dry and capsular.

This family consists of about 150 known species, all widely distributed throughout tropical regions, rarely beyond; one species is found in New Zealand. A strong astringent principle pervades the family, which when used in excess becomes dangerous.

Bead Tree or Pride of India (*Melia Azedarach*). A tree, native of India, but more probably of China. It has now become indigenous throughout Western Asia, the regions of the Mediterranean, and the Southern United States of North America. In Italy and other parts of the South of Europe, it forms a beautiful tree; it grows freely in the open air in

this country, but requires protection in winter. In some countries it attains the height of 40 feet or more, having a dense head of compound winged leaves and erect spikes of sweet-scented lilac flowers, succeeded by pale blue berries, about the size of currants, which are made into rosaries.

Crab Oil (*Carapa guianensis*). A large tree, native of Guiana, attaining the height of 60 to 80 feet, having large, shining winged leaves, of firm texture. Its fruit consists of a hard shell about 4 inches in diameter, containing a number of large brown, thick, wedge-shaped seeds, closely packed; from which, by pressure, an oil is obtained, used by the Indians for anointing their hair. It has been imported to this country. In Demerara the wood is used for many purposes; it takes a fine polish.

C. guineensis is a similar tree, native of Western tropical Africa. It differs but little from the preceding, except in having larger fruit, sometimes 6 inches in diameter. It also produces an oil.

This family is represented throughout India and the Malayan Islands by many fine timber trees, belonging to the genus *Melia*, *Sandoricum*, and *Trichilia*, species of the latter being also found in Australia. *T. Australis*, called the Australian Lilac or White Cedar Tree, is one of the few deciduous trees of that country, while in New Zealand the lofty tree *Hartighsia spectabilis* is found.

Ekebergia capensis, a small tree, represents the family at the Cape of Good Hope.

(Humiriaceæ.)

This family consists of about 20 species of trees, having simple alternate leaves and small flowers, arranged in cymes; fruit, a drupe. They are all natives of tropical America.

Humirium balsamiferum, a native of French Guiana, and *H. floribundum*, native of Brazil. The bark of the former yields a fragrant juice of a red, that of the latter one of a

yellow colour, which is burnt as a perfume, and is also used as a remedy for tapeworm.

The Terebinth Family.

(TEREBINTHACEÆ.)

Trees or shrubs, with alternate, simple, or winged leaves. Flowers small, generally in spikes or racemes; some unisexual. Fruit generally a fleshy drupe, in some small and berry-like, in others, as the Mango, large, containing a single seed.

A hundred or more species are recorded as belonging to this family; they are widely distributed within the tropics of both hemispheres, also sparingly found in temperate America, Europe, China, and Japan; they are numerous in South Africa. All contain a very acrid poisonous juice of the character of turpentine; nevertheless, some produce eatable fruits, and others many useful substances.

Mango (*Mangifera indica*). The Mango is a native of India, and now cultivated in most warm countries for the sake of its fine fruit, which is about the size of a large pear. It has narrow lance-shaped leaves, 6 to 9 inches long. A good Mango is a delicious fruit, but an inferior one is like tow dipped in turpentine. It is very easily cultivated in the hothouses of this country, and has produced fine fruit.

Cashew Nut (*Anacardium occidentale*). A large tree, native of the West Indies, having strongly veined simple oblong leaves. The fruit or nut is of kidney shape, about an inch in diameter, seated on a fleshy receptacle or footstalk. The nut is enclosed in a thick leathery skin containing a black gummy fluid, which severely inflames the mouth if unwarily bitten, but these effects are prevented by roasting. The fleshy receptacle is not unwholesome, and by fermentation yields a pleasant wine; a spirit is also distilled from it. A gum, like gum-arabic, is obtained from the tree,

and is imported under the name of Cadgii, being used as a wash to prevent the attacks of insects.

Hog Plum (*Spondias lutea*). A tree, native of Jamaica, growing to the height of 40 or 50 feet, and having much the appearance of the common ash. It is in general cultivation for its fruit, which is about the size of a walnut, of an oval shape and yellow colour, having flesh resembling the common plum. They are not much appreciated, but are used for feeding swine.

Spondias dulcis. A tree like the preceding, cultivated in many parts for its fruit, which is about the size of an apple, and of a yellowish colour. In Barbadoes it is called Golden Apple. It is common in many islands of the Pacific, and having originally come from Otaheite, has received the name of Otaheite Apple; the rind has the flavour of turpentine, but the pulp is agreeable.

Spondias tuberosa. A native of Brazil, having fruit about the size of a plum, of an oblong form and yellowish colour, and of a sweetish acid flavour, but not eatable until thoroughly ripe. This tree is remarkable for producing long aerial roots, which do not penetrate deep into the ground, but at short distances form round black tubers, about 8 inches in diameter, of a cellular texture, charged with water, each containing about a pint. These form a natural supply to the tree in the time of drought, and are sometimes used by travellers where water is scarce.

Pistachia Nut (*Pistacia vera*). A small tree, with glossy winged leaves, native of Western Asia. It appears to have been introduced to Southern Europe about the beginning of the Christian era, where in some places it has become almost naturalized. Its fruit is somewhat larger than an olive, and contains a kernel which is largely eaten in the South of Europe, and is imported to this country as a dessert fruit.

Mastic, or Lentisk (*Pistacia Lentiscus*). A small tree, not exceeding 15 feet in height and 1 foot in diameter; native of all countries bordering on the Mediterranean. On incisions

being made in the stem, a resin called "mastic" exudes, which is said to derive its name from the use made of it by the Turks, who chew or masticate it in order to sweeten their breath. In this country it is used for varnishing, also by dentists for stopping teeth. It is imported from several of the Greek islands, particularly from Scio.

There is much doubt respecting the plant yielding the "balm of Gilead" carried by the Ishmaelites into Egypt; but by restricting the localities of the plant to the rocky country of Gilead, there seems little doubt that it was the juice of *Pistacia Lentiscus* which was anciently in repute for its healing virtues.

Chio Turpentine tree (*Pistacia Terebinthus*). A native of Western Asia and countries bordering the Mediterranean. The turpentine is obtained by incisions made in the stem, and is imported from the same ports as mastic. The first two are not hardy; but a plant of the third has braved the winters of nearly one hundred years at Kew. Curious red-horned galls are produced on the trees, which are used for tanning Morocco leather.

Marking nut (*Semecarpus Anacardium*). A tree, native of India, with large oblong leaves, and fruit borne on a fleshy receptacle similar to the Cashew nut. It is roasted and eaten by the natives. The black juice obtained from the unripe fruit is used in making ink, and, when mixed with quicklime, forms an indelible marking ink. Great care is requisite in using it, as, from its acrid nature, it is apt to cause severe inflammation.

Japan lacquer (*Rhus vernicifera*). A small tree, native of China and Japan, furnishing the famous varnish with which the Japanese lacquer their ware.

Japanese wax (*Rhus succedaneum*). An evergreen tree, with shining winged leaves, native of Japan, having bunches of fruit like small grapes, which by pressure yield a wax analogous to bees'-wax; it is extensively imported to this country, and is used in making candles and night-lights. The plant has been long known in the botanic gardens

of this country, but is not sufficiently hardy to stand the open air.

Sumach (*Rhus coriaria*). A small shrub or tree, with pinnate leaves, abundant in all countries bordering the Mediterranean. It yields the article called "sumach," which is used for tanning, and consists of the young shoots and leaves ground down; it comes to this country chiefly from Sicily, where it is extensively cultivated. Another South European species is *Rhus cotinus*.

Poison oak (*Rhus Toxicodendron* and *R. radicans*). Trailing, vine-like shrubs, with broad trifoliate leaves, natives of North America, and long known in the botanic gardens of this country. The leaves are highly poisonous, serious consequences having resulted from merely handling them; but actual contact is not necessary, as they give off their baneful influences to the air, especially on hot days, causing headache and even sickness. *R. venenata*, also a native of North America, having winged leaves, is likewise very poisonous.

Schinus molle. A Peruvian shrub, with light green winged leaves, and called Peruvian Mastic tree. The leaves contain a great quantity of odoriferous oil, and on breaking and throwing fragments of them into water, the oil is expelled with such force as to cause them to jerk and twirl as if by spontaneous motion. In Italy it forms a pretty bush, but is not sufficiently hardy for the open air in this country.

Lithræa caustica. A stiff-branched shrub, with small oval leaves of a brownish colour, native of Chili; it is dreaded by the natives for its baneful effects in blistering the skin.

The Zebra-wood Family.

(Connaraceæ.)

Trees or shrubs, rarely climbers. Leaves alternate, winged. Flowers in panicles or racemes with bracts. Fruit a capsule-like follicle, opening lengthways.

This family consists of about 50 known species, natives of

America and India, of which *Connarus speciosus* is a large tree, plentiful throughout Pegu and Rangoon. The seeds abound in a sweet oil.

Zebra-wood (*Omphalobium Lambertii*). A large tree, native of Guiana; it produces one of the woods called Zebra-wood, used by cabinet-makers.

The Mahogany Family.

(CEDRELACEÆ.)

Large trees, with alternate winged leaves, bearing panicles of small flowers. Petals 4 or 5. Stamens 8 or 10, free or united in a tube. Fruit a woody-valved capsule; containing flat winged seeds.

About 30 large trees compose this family, natives of India, America, and Australia; one or two are found in West Tropical Africa. They are famed for their timber.

Mahogany (*Swietenia Mahagoni*). A native of Jamaica and Tropical America. It is a large-growing tree, with winged leaves like the Ash. The timber is largely imported to this country for furniture-making, the best coming from the British possessions of Honduras; one of the largest logs received in this country measured 4 by 5 feet square.

Jamaica Cedar (*Cedrela odorata*). A large tree, native of Jamaica, and some parts of Tropical America, having leaves like the Mahogany tree, but of a paler colour, which, with the flowers and bark, have a most disagreeable odour, resembling assafœtida. The timber is extensively used in Jamaica. It is fine grained, and comes to this country under the name of Jamaica Cedar. *C. Brasiliensis* is a similar tree, native of South Brazil, where it attains the height of 120 feet.

Toona or Chittagong Wood (*Cedrela Toona*). A large tree, native of Bengal, and the forests of Pegu. The flowers have a sweet odour, resembling honey, and contain a yellow dye. The timber is fine, and close-grained. An allied tree, *Chickrassia tabularis*, is also called Chittagong Wood.

Australian Cedar (*Cedrela australis*). A large tree, native

of New South Wales, sometimes measuring 20 or 30 feet in circumference. On account of the wood being extensively used by the colonists in house-building, large trees have become almost extinct. Judging from plants at Kew, it appears to be a fast grower, and does not seem specifically distinct from *C. odorata*.

Satin Wood (*Chloroxylon Swietenia*). A large tree, native of Ceylon and Western India, and is much prized for its fine-grained, satin-like wood, which is imported to this country, its principal use being for making the backs of toilet and clothes-brushes, and articles of fine turnery. Satin Wood comes from some of the West India Islands, and other parts, but from trees not yet ascertained.*

Yellow Wood (*Oxleya Xanthoxyla*). A native of the Eastern coast of Australia (now Queensland), attaining the height of 40 or 50 feet. Its wood is of a yellow colour, and is used for furniture. Allied to this is *Flindersia australis*, native of New South Wales, having wood like mahogany.

THE MILKWORT, SOAP BERRY, AND MAPLE ALLIANCE.

The Coca-Leaf Family.

(ERYTHROXYLACEÆ.)

Small trees and shrubs, the young shoots often compressed and covered with imbricate scales. Leaves entire. Flowers small, rising from the axis of the leaves. Fruit a small oblong 1-seeded drupe.

This family is founded on the single genus *Erythroxylon*, which contains nearly 80 species. They are natives of the West Indies and Tropical America, also of the East Indies and other tropical regions, as well as of Australia.

Coca-Leaf (*Erythroxylon Coca*). A shrub abundant in a

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* One is supposed to be a species of *Maba*, a tree belonging to the Ebony family.

wild state, and cultivated in many parts of New Grenada and Bolivia, for the sake of its leaves, which are of a stimulating nature. It attains the height of 6 to 8 feet, and is similar in appearance to the Tea tree. There are two varieties, the broad and narrow leaved, the latter being the more highly prized. The leaves are picked and scorched in an earthenware pan, and, after being dried, are ready for use. It is in general use by the Indians, both men and women, who, after partaking of their morning meal, stuff a loose handful of leaves into their mouths, with a little calcined lime; a few fresh leaves are constantly added during the day, the cheek assuming the appearance of being swollen; this, without any other food, enables them to perform a hard day's work. The Indians who chew this appear to become somewhat corpulent; their eyes assume a glassy appearance, and their features have a languid expression of dreamy complacency. It is not ascertained whether its excessive use shortens life, but aged Indians have been seen sitting quietly chewing Coca. Its effects are similar to those of opium.

The Barbadoes Cherry Family.

(Malpighiaceæ.)

Trees or shrubs, many of them twining climbers. Leaves generally opposite, or more in a whorl, glossy, and shining, entire, with glands on their petioles. Many furnished with stiff hairs attached by their centre, and lying flat on the surface of the leaf. Stipules small or large. Flowers solitary, in spikes or racemes, generally yellow and showy. Calyx 5 parted with glands at the base. Petals 5. Stamens 5 or 10, free or united. Styles 3 or 5. Fruit drupe-like and angular, or dry and winged.

This family consists of about 600 species, widely distributed throughout the tropical and subtropical regions, the greater part being natives of America. The climbing portion abound in Brazil, interlacing the trees of the forest and trailing over rocky places.

Malpighia glabra and *M. punicifolia*, have pulpy furrowed fruits, about the size of cherries, which are eaten, and being originally found in Barbadoes, are called Barbadoes Cherries. They are common throughout the West Indies.

Several species of *Malpighia*, *Hiptage*, *Banisteria*, *Heteropteris*, *Galphimia*, and others, are common in hothouses in the botanic gardens in this country, most of them being creepers, growing to a great length, with showy flowers. In *Malpighia urens*, and several other species, the leaves are covered with stiff shining hairs, lying horizontal on their surface, forming a kind of web. These hairs are very irritating and dangerous, often causing unpleasant consequences.

The genus *Nitraria* is by some botanists placed in *Malpighiaceæ*, while others consider it as the type of a distinct family. Three species have been noticed, but they are probably only different forms of one, *N. Schoberi*, a stiff, rigid, thorny shrub, with thick, fleshy leaves, the whole of a forbidding aspect, inhabiting salt plains and desert places in Siberia, around the Caspian, in Western Asia, and in some parts of North Africa. It has white flowers, and produces a small red fruit like the Barberry, which is juicy and refreshing to travellers in the desert.

(Vochyaceæ.)

This family consists of about 50 large trees and shrubs, with opposite branches, which when young are four-sided; opposite, entire leaves, with glands at their base, and flowers in terminal racemes or panicles. Their timber is of use, the most important being Copai-ye Wood (*Vochysia Guianensis*), a tree from 50 to 60 feet high, and from 2 to $2\frac{1}{2}$ feet in diameter. The wood is not very durable, but is used for making staves for sugar-hogsheads, boat-oars, &c.

The Soap Berry Family.

(Sapindaceæ.)

Trees or shrubs, often climbing by the aid of tendrils, rarely herbs. Leaves alternate, variously winged, or digitate, rarely simple. Flowers solitary, or in paniculate racemes, unisexual or bisexual. Fruit a valved 3-celled capsule, containing 1 or 2 seeds; sometimes having a wing appendage, rarely fleshy, or membranous, and inflated.

This family contains nearly 400 species, all widely distributed throughout the Tropical zone. In Northern Asia and America it is represented by the genus *Æsculus*, and in Australia by *Dodoneaa*. Some of them are of a highly poisonous nature, while others produce excellent dessert fruits in their respective countries.

Horse Chestnut (*Æsculus Hippocastanum*). Supposed to be a native of the Himalayan range of North Western India, and to have gradually found its way westward to Europe; it has been cultivated in this country probably for nearly two hundred and fifty years. Although a large-growing tree, its timber is soft and of little value; its large nuts, which it produces in great abundance, are useful in affording food for horses, sheep, and goats; and in France large manufactories have been established for procuring starch from them.

Soap Berry (*Sapindus Saponaria*). A tree, with winged leaves and winged rachis, native of the West Indies and of Tropical America generally. Its fruit is the size of large gooseberries, formed of a thick, tough skin, loosely enclosing a hard, globose seed. It takes the name of Soap Berry from the rind being saponaceous; it has long been in general use in the West Indies as a substitute for soap. The hard seeds are used for making rosaries, necklaces, &c.; and at one time were imported for making buttons. In India, an oil, called Soap Nut Oil, is extracted from *S. emarginatus*. *S. rubiginosa* is a large tree found in the Pegu forests, where it attains a girth of 3 or 4 feet, having white-coloured wood.

Litchi (*Nephelium Litchi*). A small tree, with winged, smooth leaves, extensively cultivated for its fruit in China, where it is supposed to be a native. It has become indigenous in most warm countries of the East, being common in India, Ceylon, and Mauritius. There are several varieties. The fruit is nearly of the size, and not unlike the Horse Chestnut, but soft and thin, of a red colour, containing a nut-like seed, lying in pulp. They are eaten either in a fresh or dried state, and are imported into this country.

Longan (*Nephelium Longan*). This is a tree like the last, native of Southern China. Its fruit is small, and has a smooth skin, of a yellowish-brown colour, is quite round, and of a sweet, subacid flavour. The Litchi has fruited freely and abundantly at Kew, and has produced fruit of a good flavour.

Akee (*Blighia sapida*). A tree, native of Western Africa, from which place it has been introduced to the West Indies and Tropical America. In Jamaica a tree attained a considerable height, and a diameter of 2 feet. It has large, broad-winged leaves, somewhat rough, and a three-sided fruit of a reddish colour, tinged with yellow, containing three black seeds embedded in a whitish pulp, which is acid and agreeable.

Snake Seed (*Ophiocaryon paradoxum*). A large tree, native of British Guiana, having fruit about the size of a walnut containing a single seed, the embryo of which is of dark colour, and, being coiled up, resembles a snake. It is of no medicinal use, but is considered a curiosity, and is to be seen in the Museum at Kew.

Sneeze Wood (*Ptæroxylon utile*). A small tree, native of the Cape of Good Hope. The wood is hard and durable, takes a fine polish, and is used for many purposes. It is called Sneeze Wood from the "dust" causing the sawyer to sneeze.

Melicocca bijuga. A tree, native of Guiana, introduced into the West Indies. In Jamaica it attains the height of from 40 to 50 feet, and is 4 or 5 feet in circumference. It

yields a hard and heavy timber, and produces an egg-shaped fruit that possesses an agreeable flavour.

Lac (*Schleichera trijuga*). A large tree, common throughout India, Ceylon, and Burmah. A coccus insect frequents this tree, and produces what is called Stick Lac, which is collected from the young branches, and forms part of the Ceylon Lac dye of commerce.

Alectryon excelsum. A large tree, native of New Zealand, having useful hard-wooded timber.

Cupania pendula. A lofty tree, having a stem of nearly 2 feet in diameter, native of Queensland. The wood is marked with mahogany-like patches; it takes a high polish, and is called the Tulip Wood of that colony.

Paullinia sorbilis. A strong-growing creeper, native of Brazil, chiefly in the regions of the Amazon. The ripe seeds are pounded, made into a paste, and then formed into rolls, which become dry and hard, resembling large black sausages. Under the name of Guarana they form a considerable article of trade, being carried into all parts of Brazil, where they are used for making a beverage similar to tea, and have been found to contain Theine, the principle of tea.

Paullinia pinnata. A strong climber, with winged leaves like the preceding. The whole of the plant is poisonous.

The curious walking-sticks called "Supple Jacks," are made from the slender climbing stems of *Paullinia curassavica.*

Serjania lethalis. Also a climber similar to the preceding, native of Brazil; is supposed to be the plant from which a species of Wasp collects honey that is highly poisonous. The Indians use these poisons for their arrows, also for poisoning fish.

The only hardy representative of the family is *Kœlreuteria paniculata*, a tree, native of China. A plant of this at Kew attained the height of 20 feet, with a diameter of 8 inches. It has spreading branches, with winged leaves, producing erect panicles of showy yellow flowers.

The Maple Family.

(Aceraceæ.)

Large or small deciduous trees. Leaves opposite, simple, entire, lobed or pinnate, rarely compound winged. Flowers from the axis of the leaves, in spikes or racemes, small, unisexual or bisexual. Petals 5 or none. Stamens generally 8. Fruit consisting of 2 united-winged nuts, each containing a single seed.

About 60 species constitute this family. They are common throughout the Northern hemisphere, being represented in Europe by several species of *Acer;* they are also found in India and Japan, but the greater number are natives of North America. None are found in the Southern hemisphere.

Sugar Maple (*Acer saccharinum*). A moderate-sized tree, native of North America, where it forms extensive forests. It is of great importance for its juice, which is obtained in early spring by tapping, and converted into sugar. A tree will yield from two to four pounds yearly, and will continue to do so for forty years without suffering injury. It has become an article of commerce under the name of Maple Sugar, which is made up in the form of thick cakes. The wood called Bird's-eye Maple, used by furniture-makers, is the old distorted growth of the trees.

Acer rubrum, *A. platanoides*, and others, are all useful timber trees, the wood being used for many purposes. *A. Negundo*, a native of North America, is a fast-growing, wide-spreading tree, differing from the rest of the genus in having winged leaves. It is an ornamental tree in the gardens of this country.

The Milkwort Family.

(Polygalaceæ.)

Shrubs or herbs, with alternate, rarely opposite leaves, sometimes heath-like. Flowers solitary or racemose, sometimes very small, or, as in the Cape species of *Polygala*,

showy. Sepals 5, coloured. Petals 3 or 5, unequal, 2 often united (keel-like), 1 large and crest-fringed. Stamens 4, distinct, or 8, unequal, usually combined in a tube, which is either entire or split in two parts. Pistil 1. Fruit dry, drupaceous, or flat and winged like a samar; 1-seeded.

About 500 species are enumerated in this family, and are widely distributed over the temperate and tropical regions.

The South African species are showy favourites in the greenhouse. In Australia they are represented by the pretty genus *Comesperma*, and in this country by the common Milkwort, *Polygala vulgaris*, a neat little plant, with blue or white flowers. A bitter astringent principle pervades this family; some are poisonous. Some species of *Securidaca* yield strong fibre.

Rhatany (*Krameria triandra*). A perennial, with strong reddish roots, native of Peru. The roots are largely imported into Portugal, where an extract is made from them, and used in colouring port wine. When prescribed alone, it is a valuable tonic, and it is believed that the medicinal properties of port wine are due to it; but it has now lost its reputation, and little is imported.

Snake Root (*Polygala Senega*). An erect, slender, herbaceous plant, with lance-shaped leaves, native of North America, having strong, thick, branching roots, covered with ash-coloured bark, and supposed to resemble the tail of the rattlesnake, as a remedy for the bite of which it has been long famed among the Indians. It is employed medicinally for many complaints in the United States. A principle called Senegin has been found in this plant; it is a brown substance, and excites violent sneezing.

THE CAMELLIA, GAMBOGE, AND TUTSAN ALLIANCE.

(Dipterocarpeæ.)

Generally large trees. Leaves alternate, with parallel veins running from the midrib to the margin, and deciduous

stipules. Flowers large, axillary, and solitary, or in racemes. Calyx tubular. Petals and stamens 5 each, the latter distinct or united in bundles. Fruit leathery, 3-valved, containing a winged seed.

This family consists of about 50 species, natives of India, Java, and the Malayan Islands, where they form the largest trees of the forest. They contain a resinous secretion.

Sumatra Camphor (*Dryobalanops Camphora*). A native of Sumatra and Borneo, the juice of which becomes crystallized in fissures in the interior, and to obtain it the tree has to be cut down; the quantity yielded by each tree is often not more than a few ounces, and on that account it is very high-priced. It is less volatile than the Chinese Camphor, but is more valued by the Chinese and Japanese. In Sumatra it is used for embalming the bodies of deceased rajahs, and the large quantity required for this purpose helps to keep up the price.

Gum Animi, Indian Copal (*Vateria Indica* and *V. Malabarica*). Tall, smooth-barked trees, natives of Ceylon and Malabar. They yield a gum resin, which is used in this country as a varnish, and in India is made into candles that have a fragrant smell when burning; it is also burnt for incense.

Sâl Wood (*Shorea robusta*). A native of India, stretching from the Bengal provinces to the foot of the Himalayas. It attains the height of 100 feet. The wood is hard and tough, and is used for shipbuilding and other purposes where strength and toughness are required. It yields a resin known as Dammar (a common name for gum resins throughout India and the Malayan Islands), and an oil is obtained from its seeds.

Wood Oil. This is obtained from several species of *Dipterocarpus*.

D. turbinatus. A large tree, native of Chittagong, attaining the height of 200 feet, with a girth of 10 feet. It yields a large quantity of oil, which is obtained by cutting large holes in the tree, when fire is applied, which causes the oil to

run out. In India it is used for many purposes, as pitch, varnish, &c.; and medicinally as a substitute for Copaiba Balsam; it is imported from Moulmein as such. The timber is used for boatbuilding.

In Borneo it is said there are several species of *Dipterocarpus*, that produce a nut from which is expressed a fatty oil, extensively used as vegetable tallow or wax.

The Tea Tree Family.

(TERNSTROMIACEÆ.)

Small trees and shrubs, some climbers. Leaves alternate, simple, entire, or toothed, sometimes with pellucid dots. Flowers axillary or terminal, generally solitary or nearly so, red or white. Petals 5 or more, united at their base. Stamens numerous, distinct, or united in one or several parcels. Fruit a capsule containing large seeds. Of the 130 species that constitute this family, fully one-half are natives of South America, the rest being distributed throughout India, China, and North America.

Tea tree (*Thea Bohea* and *T. viridis*). Names applied to the black and green tea-plants, but now understood by botanists to be varieties of one species.

T. chinensis, a small much-branched tree or shrub, not exceeding 10 or 15 feet in height, having elliptical, lance-shaped leaves 2 or 3 inches in length. It is extensively cultivated throughout China and Japan; and, like many other plants long cultivated by man, its native country is uncertain; it is, however, undoubtedly found wild in Assam, and is supposed, in progress of time, to have migrated eastward to China. An infusion of the leaves has, from time immemorial, been used by the Chinese as a beverage for its exhilarating properties.

It was supposed that black and green teas were the produce respectively of the two varieties of the plant, but it is now known that both kinds are made indiscriminately from either, the difference depending on the age of the leaf when gathered,

and the mode of preparing and drying. Originally, pure green tea was considered the finest, and brought the highest price; the demand led to its being artificially coloured, even almost to shiny blue, as may be sometimes seen in grocers' windows. This is chiefly done to meet the English taste, the Chinese tea-dryer saying he would as readily make yellow or red tea, if these colours would fetch a higher price. The substances used for the processes of colouring are to be seen in the Museum at Kew, and may be considered quite genuine, as they were obtained during the time the process was being performed. Tea now forms one of the greatest articles of commerce in the civilized world; and although as an article of food it could be dispensed with, yet it has become such a universal beverage, that to be deprived of it would be felt as a great loss. It was introduced into Europe by the Dutch two hundred years ago, but does not appear to have been used in England until one hundred years later, and was rare at the end of the eighteenth century; indeed, it may be said that it is only during the present century that it has come into general use with rich and poor. For the Northern Asia and Russian markets tea is made up into solid hard lumps like bricks, and is boiled and eaten as a vegetable. In Assam, the native tea-plant has been cultivated for more than twenty years; and more recently, the Chinese varieties have been introduced into India, and extensive plantations formed in the cooler regions. Large quantities have been manufactured, but as yet it is wholly consumed in that country. The virtues of tea are due to a principle called "Theine," which is also contained in Paraguay tea and coffee.

Camellia (*Camellia Japonica*). This beautiful and well-known shrub is a native of China and Japan, and is recorded as being introduced into this country some time previous to 1740. The normal character of the flower is single red, but the double, of both red and white, as well as a variety called Waratah, have been long cultivated at Kew. During the last fifty years many fine new varieties have been raised,

and Camellias have become one of the most important trade-plants, both in this country and on the Continent.

Camellia Sasanqua. A small-leaved species growing in the form of a bush. It attains the height of from 12 to 15 feet, and bears a profusion of white flowers. It is often planted as a shelter for tea-plants, and its leaves are frequently mixed with tea. The Chinese have an idea that the flowers scent the tea-leaves, and therefore collect the latter while the Sasanqua is in flower. The seeds of this and of Camellias in general contain a great quantity of oil, which is much used for domestic purposes in China.

Visnea Mocanera. A shrub, native of the Canaries, having small shining elliptical leaves and white flowers, like the tea-plant. Linnæus gave it the name of *Mocanera*, on the supposition that its fruit was the Mocan, used as food as well as in medicine by the ancient extinct race of the Guanches, the original natives of the Canaries. Plants of it were introduced at Kew about 1815, and are kept in the greenhouse.

Stuartia pentagyna, *S. Malachodendron*, and *Gordonia lasianthus*, represent the family in North America. They are deciduous shrubs, having large white showy flowers, and are hardy but rare in this country.

The Souari-Nut Family.

(Rhizobolaceæ.)

Large trees, with alternate or opposite thick trifoliate leaves, jointed at the foot-stalks. Flowers large, with jointed peduncle. Petals 5 or more. Stamens numerous, monadelphous, in 2 rows. Fruit consisting of one or more united nuts.

About 10 species of large trees, natives of various parts of tropical America, constitute this family.

Souari or Pekea Nut (*Caryocar nucifera*). A native of British Guiana and Brazil, often attaining the height of 100 feet. The fruit is globose, and when perfect contains

5 large, hard-shelled, flat nuts (seeds), which when dry are brown and warty. They are frequently imported to this country, and contain a nutty kernel, which is eaten, and from which an oil is expressed.

C. butyrosum, the Butter Nut, is a tree similar to the last, also producing eatable nuts, but they are too oily to be much in favour.

The Gamboge Family.

(GUTTIFERÆ.)

Trees or shrubs, sometimes adhering by their roots to other trees (*Clusia*). Leaves opposite, often thick, entire, with parallel veins running from the midrib to the margin. Flowers usually several together on short footstalks, axillary or terminal. Petals variable in number, generally of a firm texture. Stamens numerous, distinct or united in one or more parcels. Stigma often sessile, rayed. Fruit dry, 1- or many-celled, with the seeds embedded in the pulp.

This handsome family is represented by 150 or more species, widely spread throughout the tropics. The whole contain a resinous yellow juice, and some are of high importance for their fruits.

Gamboge (*Garcinia Morella*). A small tree, common in Siam and Cambodia. The fruit is a pulpy drupe, about 2 inches in diameter, of a yellow colour, and is esteemed as a dessert fruit. The most important product, however, is the gum which exudes on incisions being made in the stems, and when hardened, is collected and made into cakes, forming the gamboge of commerce; the best comes from Siam and Cambodia, and is believed to be obtained from a variety of the above species.

Mangosteen (*Garcinia Mangostana*). A native of Molucca, and other spice islands, and has become indigenous in Java, Singapore, and other parts of the East. It is a tree about 20 feet high, with opposite horizontal branches, and firm, smooth, elliptical leaves. The fruit is about the size of a small apple, of a yellowish-brown colour, crowned with the

persistent rays of the stigma. It is considered one of the most delicious fruits known, being peculiarly grateful and refreshingly cool to the taste.

Xanthochymus pictorius. A native of many parts of India, similar in growth to the Mangosteen, but has longer, firm leaves and an oblong fruit; it is nearly as much esteemed. In this country it grows and fruits more freely than the Mangosteen. *X. ovalifolius* is similar but has blunter leaves; it is a native of Ceylon. Both these yield gamboge, but of inferior quality.

Hog Gum (*Moronobea coccinea*). A lofty tree, native of the West Indies and many parts of tropical America. By incisions it yields a gum of the consistency of Burgundy pitch, obtained in considerable quantities. In Jamaica it is known as Hog Gum, it is said from Hogs rubbing themselves against it as it issues from the trees.

Butter and Tallow Tree (*Pentadesma butyracea*). A tree, native of Sierra Leone, and other parts of Western tropical Africa. It attains the height of 30 or 40 feet, and bears an inversely pear-shaped fruit of a dark brown colour containing a yellow greasy juice, which is used by the natives mixed with their food, but its strong turpentine flavour is not palatable to Europeans. It is sold as butter in the markets of Freetown, but it must not be confounded with Shea butter.

Mammee Apple (*Mammea americana*). A native of the West Indies and of tropical America. It attains the height of 60 or 70 feet, and has broad, smooth, firm, ovate leaves, and fruit of an angular form, the size of a small melon, with a tough skin enclosing another thin yellow skin, firmly adhering to the flesh, which is also of a yellow colour and has a pleasant taste. It is a common table fruit, and is made into a preserve. The bark is a powerful astringent, and even poisonous.

Calophyllum inophyllum. A native of India and of the Malay and other islands. It attains the height of from 80 to 100 feet. The trunk yields a resin, and an essential oil is obtained from the seeds. It is a handsome tree and is often

planted near dwellings for the shade it affords. *C. calaba* is a similar tree, but with longer leaves, native of the West Indies and tropical America, where its wood is known as Santa Maria Wood. It is said to be suitable for ship-building, and a quantity was sent to this country some years ago for that purpose, but was not much appreciated. The seeds yield an oil.

Clusia alba and *C. rosea*, natives of the West Indies and tropical America are small much-branching trees of a shrubby character, with thick leathery leaves. They produce thick aerial roots with which they cling to other trees, or descend to, and become fixed in, the ground, similar to the Banyan tree.

The West Indian Ivy Family.

(MARCGRAVIACEÆ.)

Trees or shrubs, often clinging climbers. Leaves alternate, entire, often thick and shining. Flowers in umbels, spikes, or racemes, furnished with bracts, which are sometimes hooded or bag-shaped. Petals 5, imbricated, or hooded. Stamens generally numerous. Fruit succulent or capsular. Seeds numerous.

About 30 species are enumerated of this family. They are natives of the West Indies and tropical America, where they climb over trees like ivy. The curious structure of their flowers invests them with botanical interest. They are represented in the hothouses of this country by *Norantea coccinea* and *Marcgravia umbellata*.

The Tutsan Family.

(HYPERICACEÆ.)

Herbs, shrubs, or frutlets. Stems generally angular. Leaves opposite, rarely alternate, entire, often with pellucid dots, some heath-like. Flowers solitary or somewhat umbellate or panicled. Petals 4 or 5, unequal sided and twisted in the bud, bordered with black dots. Stamens numerous, distinct or united in 1 or more parcels. Pistils 3-5. Fruit

generally a many-celled, dry capsule or berry with numerous seeds. This family is represented by nearly 300 species, widely distributed over the temperate and tropical regions. The genus *Hypericum* or St. John's wort is the most numerous in species, the most showy being *H. Androsæmum*, Tutsan or Park Leaves, a native of this country. It is a low shrub, having smooth, glossy leaves and yellow flowers.

About 11 species of *Hypericum* are natives of this country. The largest representatives of the family are *Ancistrolobus carnea* and *A. mollis*, natives of the forests of Pegu; they are tall growing trees, but seldom exceed 3 feet in girth; they have dark brown wood.

Vismia Guianensis, a small tree, native of Guiana, yields a resin called American Gamboge. The genus *Carpodontos* also consists of large trees, *C. lucida* being a beautiful flowering tree, native of Mount Wellington, Tasmania. It has been introduced into this country. The genus *Reaumuria* is by some botanists made the type of a distinct family. It consists of only 4 known species, differing from *Hypericum* in the calyx being bell-shaped, and furnished with bracts. They are small branched trailing or bushy shrubs with soft, thick, fleshy, flat or heath-like leaves, of a bluish hue, and are natives of the salt plains of Western Asia and North Africa. They contain saline matter. *Reaumuria hypericoides*, native of Syria, is a small heath-like trailing shrub, with pretty pink flowers; it has long been cultivated at Kew.

THE MALLOW AND LINDEN TREE ALLIANCE.

The Linden Tree Family.

(TILIACEÆ.)

Trees or soft wooded shrubs, rarely herbs. Leaves simple, alternate, often heart-shaped, with stipules. Flowers solitary or many together on leafy bracts. Sepals and petals 4 or 5 each. Stamens numerous, part in some sterile. Fruit a 5 or 10-valved capsule, sometimes winged, often prickly or

succulent. Of this family about 350 species are enumerated, which are widely distributed throughout the temperate and tropical regions, and consist either of lofty hard wooded trees with tough fibrous bark, or of mean weeds.

Lime or Linden Tree (*Tilia europea*). This is found wild throughout the whole of Europe and parts of Asia. It is a bushy-headed tree, averaging, but often much exceeding, 40 or 50 feet in height. The wood is light and white, and is much esteemed by carvers, musical instrument makers, and others. The fibre of its bark is also extensively used for making garden mats, which are imported into this country from Russia in vast quantities. When in flower the Lime trees are odoriferous, and much frequented by bees. Two species, natives of North America, and the beautiful *T. alba*, a native of the east of Europe, are grown in this country.

Jute (*Corchorus capsularis*). A weedy plant, found wild throughout India and other parts, and extensively cultivated for its fibre. It is an annual, and under cultivation has a slender stem, attaining the height of 8 or 10 feet, having simple jagged leaves, and small yellow flowers. It is extensively used in the East for making what are called Gunny bags, for the export of sugar, coffee, rice, &c., and vast quantities of it are conveyed to America as well as to this country, where it enters largely into the manufacture of carpets and other goods, even of the finest quality. The fibre being liable to spontaneous combustion, it has been the cause of disastrous fires, both in ships and warehouses.

Jews Mallow (*Corchorus olitorius*). This is a species similar to the last, and widely distributed over the same regions. Its fibre is used as jute; it is cultivated in many parts, especially Egypt and Syria, for its young shoots which are eaten as a vegetable, and as it is used by the Jews, the name Jews Mallow has been given to it.

One of the largest Indian trees of this family is *Brownlowia elata*, growing to a great height in the Chittagong and Pegu forests, and sometimes attaining a diameter of 5 feet. It has entire cordate leaves like the lime, but larger and firmer in

texture. Another tree of India is *Elæocarpus Ganitrus*, the hard nuts or fruit stones of which are used for making rosaries, buttons, bracelets, necklaces, and other similar articles; specimens may be seen in the museum at Kew.

The genus *Sloanea* consists of large trees, natives of tropical America and the West Indies. *S. Jamaicensis* (*dentata*) has very hard wood, and is known in Jamaica by the name of Break-axe.

The genus *Grewia* consists of bushy shrubs or small trees with pretty little pink flowers, natives of India and the Asiatic Islands. They have tough bark, which is used for many purposes. The wood of *G. occidentalis*, native of the Cape of Good Hope, is elastic, and is used for many purposes where elasticity is required. It has been long cultivated at Kew.

The genus *Triumfetta* consists of many species, widely dispersed throughout the tropical regions. They are either soft-stemmed herbs or fruticuls, having broad leaves with stellated pubescence and small yellow flowers. In their habit of growth and in their fibre they resemble the Jute.

The Chocolate Nut Family.

(Byttneriaceæ.)

Soft-wooded trees or shrubs, with alternate entire leaves, smooth, or covered with star-like hairs. Flowers in clusters, on short stalks, produced on the stems or branches, or in terminal spiked panicles or umbels. Petals 4, 5, or none, variable in form. Stamens 5, 10, or more, one half of which are sometimes sterile, free or united. Fruit a short or long, generally 5-celled, many-seeded, indehiscent capsule.

About 400 species constitute this family. They are plants of tropical and temperate climates, being represented in Australia and South Africa by shrubs, while the magnificent *Dombeyeæ* and *Astrapeæ* are natives of Mauritius and Madagascar, and *Theobroma* of America. They contain a mucilaginous principle.

Chocolate (*Theobroma Cacao*). A small tree, native of tropical America, where it is widely distributed and cultivated. It grows from 16 to 18 feet high, and has large oblong-pointed leaves of a thin, paper-like texture, very tender when young. The flowers are small, and produced on the old stem and branches, and in time are followed by a pod-like fruit 6 to 10 inches in length, and 3 to 5 in girth, marked with longitudinal ribs, and containing 50 or more seeds. These when ripe are taken from the pod and allowed to undergo a slight fermentation, after which they are dried in the sun, when they acquire a brown colour and become the Chocolate Bean or Nut of commerce. Millions of pounds are annually brought to Europe, the chief supply coming from Trinidad and Granada. In order to give them a fictitious higher value they are sprinkled with water and dusted with red earth, being frequently turned while drying. This accounts for the supposed discovery that chocolate was purposely adulterated with red earth.

In process of manufacture the two cotyledons separate, and form what are called cocoa-nibs. These when ground and formed into cakes, flavoured with vanilla and other substances, constitute the different kinds of chocolate sold in shops. The highly praised virtues of Cacao led to its being called Theobroma, meaning food of the gods.

St. Helena Ebony (*Dombeya melanoxylon*). This is one of the special plants, found only in the small island of St. Helena, and is now nearly, if not entirely, extinct, the trees having been used for firewood. The largest one standing some years ago was from 10 to 15 feet high, with crooked stems about the thickness of a man's thigh, having numerous spreading branches, and small, more or less heart-shaped tomentose leaves. In old trunks the wood is hard and black, and is called ebony. A second species, *D. erythroxylon*, Red Wood, has been described, but it is now believed to be only a younger state of the above, and is not now found in the Island.

Astrapæa Wallichii, *A. viscosa*, *Dombeya mollis*, *D. vi-*

burnifolia, *D. amelia*, and *D. opalifolia*, splendid flowering trees, natives of Mauritius and Madagascar, have been grown and flowered in the Palm House at Kew, some having attained the height of 20 feet, being conspicuous for their large leaves and heads of flowers. The Australian section of the family is represented in the greenhouse by species of the genus *Lasiopetalum*, and the South African section by species of *Hermannia* and *Mahernia*.

The Silk Cotton Family.

(Bombaceæ.)

Magnificent trees or shrubs. Leaves alternate, entire, lobed or digitate, with deciduous stipules. Flowers terminal or sessile on the stem and branches, small or very large and showy, some unisexual. Sepals 5, more or less united. Petals 5, or none. Stamens numerous, united, forming a longer or shorter tube. Fruit capsular, with the seeds involved in silky, wool-like hairs, or a follicle with numerous seeds, or indehiscent and gourd-like, with the seeds imbedded in pulp.

About 130 species are enumerated of this remarkable order of gouty trees, which are principally natives of tropical climates.

Baobob or Monkey Bread, also called Sour Gourd (*Adansonia digitata*). A native of Tropical Africa, extending from east to west. It is a remarkable tree, growing to the height of 40 feet, but its girth is entirely out of proportion to its height, some trees being 30 feet in diameter, becoming contracted towards the top. Humboldt speaks of it as the "oldest organic monument of our planet," and Adanson, a botanical traveller, in 1794 made a calculation that one of these trees, 30 feet in diameter, must have been at least 5150 years old. The wood is soft and the negroes cut out chambers in the trees, which they use as places of interment. It produces a large oblong, woody, indehiscent, capsular fruit, from 8 to 12 inches or more long, shaped like

a gourd, covered with velvety down, and containing numerous seeds the size of large peas, imbedded in pulp which ultimately becomes dry and of a corky nature. It forms a great part of the food of the natives, and was the chief support to Major Pedley's expedition, for 10 or 12 days, when in search of Mungo Park. Excellent ropes are made of the bark. As an example of the slow growth of this plant, one at Kew, though more than eighty years of age, was only 4½ feet high, but with the characteristic swollen gouty base 6 to 7 inches in diameter.

Adansonia Gregorii. A native of North Australia, and first observed by Allan Cunningham during Captain King's voyage of survey in 1818, who called it the gouty tree, on account of its remarkable obesity. When seen at a distance it has the appearance of an oblong pear set on end. Since that time they have been seen and described, and drawings made of them, by several travellers. They grow either singly, or several apparently from the same root, the largest one measured being 85 feet in girth and not exceeding 25 to 30 feet high. The leaves and fruit are produced from a small tree-like stem, growing out of the top. The wood is exceedingly soft and full of moisture, which it readily yields on pressure, affording a grateful beverage to travellers in the arid places where they grow. The fruit is smaller than that of the preceding.

Bottle Tree of Australia (*Delabechea rupestris*). A tree, native of North-eastern Australia. It is allied to the preceding, but more erect, and not so large, sometimes bulged out in the middle, having the appearance of a barrel or bottle, with what would appear to be a small tree growing out at the top, answering to the neck of the bottle. Its stem is very open, soft and porous, and contains a mucilaginous gum. It has narrow digitate leaves. Plants of it, with the gouty foot, may be seen at Kew.

Hand Flower Tree (*Cheirostemon platanoides*). A native of Guatemala, but first known by a single tree of great age growing near the city of Mexico. It is a large soft-wooded

tree with heart-shaped, lobed leaves, and is remarkable for the stamens being red, and so united and turned to one side of the flower, that they bear some resemblance to an infant's hand.

Silk Cotton. This is the produce of several species of *Bombax*, which are large trees in tropical America. The fruit is a valvular capsule compactly filled with a beautiful silky fibre, which is very elastic, expanding greatly on the opening of the pod, but, as it cannot be woven, is only used for stuffing cushions.

Ceiba (*Bombax Ceiba*). Another silk cotton tree, native of the West Indies, attaining a great height. Its stem is covered with rough tuberculated prickles, and is remarkable for having thick projecting buttresses of such size that in Jamaica horses have been stalled between them.

Bombax Malabaricum. A tree similar to the preceding; the silk cotton tree of India.

Cork Wood of Jamaica (*Ochroma Lagopus*). A tree 40 feet high, common on the sea shores of the West Indies and Central America. The wood is soft, easily compressed and used in Jamaica as a substitute for cork.

Durian (*Durio Zibethinus*). A large tree, with simple oblong leaves, native of the Malayan Archipelago. It bears a large capsular fruit 8 to 10 inches in length, covered with hard prickles, containing seed enveloped in a luscious pulp, delicious to eat, but of a very fœtid odour, repugnant to Europeans. It is nevertheless considered one of the finest tropical fruits.

Cola (*Sterculia*) *acuminata*. A tree, native of Western tropical Africa. It attains the height of 30 or 40 feet, having smooth, entire, oblong elliptical leaves 6 to 8 inches in length. The fruit is a follicle containing several nut-like seeds, which are called Cola or goora-nuts. They form a considerable article of trade amongst the negroes, by whom they are held in high estimation. The tree is also common in the West Indies and Brazil, having originally been introduced by the slaves from Africa.

Sterculia fœtida, *S. urens*, *S. colorata*, *S. campanulata*, and others, are common trees in India, useful chiefly for their fibrous bark, which is converted into strong ropes, sacks, and clothing.

Sterculia acerifolia. A tree, native of New South Wales, attaining the height of 60 or 100 feet, and a circumference of from 6 to 8 feet, having smooth, large, lobed leaves, and racemes of showy red flowers, which are produced before the expansion of the leaves, and are so numerous as to give to the tree when seen at a distance the appearance of a flame of fire, whence the name Flame tree (see Flame tree, page 337).

Plagianthus betulinus. A tree, native of New Zealand, attaining the height of 60 or 70 feet, but more often seen as only a bush. Its fibre is fine and white, like flax, very tough, and is used by the natives for making cords, ropes, and the like. A plant grown at Kew had a stem 3 inches in diameter, which on being cut down exhibited fine layers of white fibre similar to the lace bark of Jamaica.

Matisia cordata. A tree upwards of 30 feet in height, native of New Granada. It has large heart-shaped leaves, and firm fruit of an oval form, 5 inches in length and 3 broad, covered with a silky ash-coloured down, and fleshy in the interior. In taste it is by some compared to an apricot, while others think it more like the mango. It is sold in the markets of New Granada and Peru. It has been introduced at Kew, and specimens of the fruit are to be seen in the museum.

The Mallow Family.

(Malvaceæ.)

Small soft-wooded trees, shrubs, or herbs, with alternate, entire, lobed, palmate, or otherways divided leaves furnished with stipules, the whole plant often covered with stellate hairs. Flowers usually axillary or in spikes, showy, often with double calyx or involucrum. Sepals 3 to 5 or more. Petals 5, twisted in the bud. Stamens numerous, united, forming a tube. Pistils 1 to 3 or more, with rayed stigmas.

Fruit a capsule, pulpy or dry, with the seeds involved in wool-like hairs.

Not less than 1000 species constitute this family, being widely distributed over the temperate and tropical regions of both hemispheres. Many are of weedy nature, but generally have pretty flowers. They abound in mucilage, and are not known to contain any poisonous qualities.

Cotton (*Gossypium herbaceum*). Next to food plants the cotton plant may be considered first in importance to man. Cloth woven from the hairs of its seeds has been a universal article of clothing to all civilized and semi-civilized people from time immemorial. It is recorded as having been in use in India and Egypt many centuries before the Christian era. Herodotus speaks of the Indians having a plant producing wool like that of sheep, and according to Pliny it was early cultivated in the South of Europe. On the discovery of America it was found to be known there, the remains of cotton cloth having been discovered in the tombs of the Incas, thus proving it to be of ancient date. The weaving of cotton cloth in this country is said to have commenced about the end of the sixteenth century, but it was not until cotton became extensively cultivated in the then British colonies of North America that its manufacture attained importance. About the middle of the last century it received a great impetus by the invention of cotton spinning machinery. Raw cotton now became the chief article of import trade to this country, and the manufactured goods the chief article of export, being sent to all nations of the earth.

There are several varieties of the cotton plant, which assumes different characters under cultivation. It is generally treated as an annual, but if left alone, under favourable circumstances, it becomes a branched shrub 6 or 8 feet high. The flowers are very showy, being yellow, pink, or red, followed by a 3 or 5-celled capsule, about the size and shape of a fig, which when ripe bursts open through the middle of each cell, presenting a mass of fine white filaments, to which the seeds are attached. These white filaments constitute the cotton

imported in bales to this country. Since the Civil War in the United States the cultivation of cotton has increased in many other countries, and a considerable supply now comes to this country from India and Egypt. The seeds contain a large quantity of oil, and are used for making oil-cake for feeding cattle, but it is necessary to deprive them of their outer covering, otherwise the cake is unwholesome.

Marshmallow (*Althea officinalis*). A strong growing perennial, native of this country. It attains the height of about 3 feet, and is of a hoary aspect. It is cultivated in certain districts, and is held in repute as a medicinal plant, being used chiefly in fomentations and gargles; the juice of the root is used in the preparation of cough lozenges.

Hollyhock (*Althea rosea*). This well-known showy garden plant is a native of China, but has been cultivated in this country for more than three hundred years; it has now become indigenous in the South of Europe. Many fine double varieties have been raised. It possesses a strong fibre, and attempts have been made to introduce it in the manufacture of paper, &c., but they have not been attended with much success. A colouring matter is obtained from it.

Cuba Bast (*Paritium elatum*). A tree, native of Cuba and Jamaica, attaining the height of from 50 to 60 feet, having large cordate, smooth, green leaves. Its timber is of a greenish colour, and is used in Jamaica in cabinet making; but the most important part is its beautiful lace-like inner bark, which was originally employed for tying up parcels of the real Havannah cigars. About fifteen years ago it was largely imported into this country for garden purposes, but it has now fallen into disuse. Other species of *Paritium* have tough bark, especially *P. tiliaceum*, a native of tropical coasts and abounding throughout the islands of the Pacific, where its bark is largely employed by the natives for making ropes and nets, and its light wood for canoes.

Thespesia populnea is also a common tree on tropical coasts of both hemispheres, and its bark is used for similar purposes as the above. In Demerara it is used for making

coffee bags. Its wood is hard and indestructible under water. Its pretty yellow flowers with purple centre make it a favourite in hothouses.

Sida rhomboidea and *S. rhombifolia*, natives of India, *S. tiliæfolia* of China, and *S. retusa* of Queensland, are weedy plants with slender stems, attaining the height of 3 or 4 feet, having fibre equal to jute or hemp, but they are not so extensively cultivated.

Blacking-plant (*Hibiscus rosa-sinensis*). A shrub or small tree, native of China. It is a showy plant in hothouses, having red or yellow flowers, which when bruised yield a black juice, used in China for colouring the eyebrows and for blacking shoes.

Syrian Rose (*Hibiscus syriacus*). A stiff-branched deciduous shrub attaining the height of from 4 to 6 feet, native of Syria, introduced into England at the end of the sixteenth century. It is the only shrub of the family hardy in this country, and is well known in gardens by its pretty pink flowers in autumn. The mucilaginous seed-vessels of *Hibiscus esculentus* are in the West Indies known by the name of "Ochro Pods," and are used for thickening soups.

The family is represented in this country by the Marsh Mallow, already noticed; by three species of *Malva*, and the Tree Mallow (*Lavatera arborea*), a plant native of some parts of the south coasts of England and the Bass Rock in the Firth of Forth. In its wild state it has a stem about the size of a walking-stick, rising to the height of 3 or 4 feet, and quite hard, but when cultivated it grows to the height of 6 or 8 feet.

THE TROPÆOLUM AND GERANIUM ALLIANCE.

The Indian Cress Family.

(TROPÆOLACEÆ.)

Herbs, annual or perennial, some with tuberous roots, and trailing or climbing, succulent or wiry slender stems. Leaves alternate, generally round, lobed, or more or less divided.

Flowers solitary, rising from the axes of the leaves. Sepals 3 to 5, equal, or one in the form of a spur. Petals 3 to 5, equal or unequal, entire or fringed. Stamens 6 to 8 or 10. Fruit consisting of three loosely united nuts, each containing one seed.

This family consists of about 50 species, exclusively natives of North and South America.

Indian Cress, commonly called Nasturtium (*Tropæolum minus* and *T. majus*), natives of Peru, are well known garden plants, of which there are many varieties. The fruit forms a common pickle.

Canary-bird Flower (*Tropæolum peregrinum*). A favourite arbour plant with cottagers, native of New Granada. *T. Lobbi*, a native of Peru, a species with round shield-like leaves, is a showy green-house creeper, of which there are several varieties. *T. tuberosum*, also a native of Peru, has tuberous roots like small potatoes, for which it was once supposed they would become a substitute, but their taste is not pleasant. In Bolivia, however, they are said to be made agreeable by some process of cooking.

The Balsam Family.

(Balsaminaceæ.)

Succulent stemmed annuals, erect or trailing. Leaves alternate, simple. Flowers solitary, generally axillary. Sepals and petals 5 each, unequal, one of the latter forming a hollow or projecting cucullate spur. Stamens 5. Fruit a 5-valved roundish or long capsule, with numerous seeds, bursting when ripe with elastic force.

Above 100 species constitute this family, all, with few exceptions, belonging to the genus *Impatiens*, principally natives of Ceylon and India, growing in cool moist situations. *I. Noli-me-tangere*, Touch-me-not, is a native of this country, found on the banks of the Thames. They are ornamental garden plants, some being hardy enough to flower in the open air, while *I. latifolia* and *I. Hookeri* assume a shrubby character

in the hothouse. The Garden Balsam, *I. Balsamina*, native of the East Indies, has been cultivated for more than 250 years, and many fine varieties have been raised with double flowers.

The Oxalis Family.

(Oxalidaceæ.)

Trees, small shrubs, soft frutlets, or herbs, often tuberous rooted. Leaves alternate, simple, trifoliate, or more compound. Flowers generally solitary, on long footstalks, usually of showy colours. Sepals 5. Petals 5, equal, spirally twisted before opening. Stamens 10, free or united. Pistils 3 or 5. Fruit a valved capsule, which is either membranous or succulent.

About 350 species compose this family, the principal part belonging to the genus *Oxalis*, and abounding as bulbous-rooted plants in South Africa. In Tropical America they are small shrubs, and in India they are represented by small trees. They contain an acid principle, called oxalic acid.

Blimbing (*Averrhoa Bilimbi*) and Carambola (*A. Carambola*). Small trees, seldom attaining the height of 20 feet, having winged leaves. They are natives of India, and are cultivated in tropical countries for their fruit, that of the first being oblong and pulpy, about the size of the thumb, like a small cucumber, of a yellowish colour. The fruit of the latter is about the size of a hen's egg, and three angled, having soft flesh like a plum, exceedingly juicy and refreshing. Both are made into pickles, and the flowers into conserves.

Arracacha (*Oxalis crenata*). A native of Peru, New Granada, and other parts of Tropical America, where it is cultivated for its tuberous roots, which are about the size of a hen's egg, the skin being full of eyes, like a potato. It was introduced into this country about thirty years ago, when it was supposed that it would become a useful garden vegetable, but it was found to be watery and insipid.

O. Deppei. A native of Mexico, also having tuberous roots, which are a little more farinaceous than the preceding.

It is not much cultivated in this country, but more so in France, the stalk and leaves being cooked in various ways, and also used as salad.

Wood Sorrel (*Oxalis Acetosella*). A hardy perennial, native of Britain, growing wild in woods. The leaves are sometimes used in salads, to which they impart a pleasant acid. Having trifoliate leaves it is one of the plants supposed to be the shamrock of Ireland.

O. Bowei and other species, natives of the Cape of Good Hope, are showy garden plants, but not sufficiently hardy to stand the winters of this country without protection. *O. bupleurifolia*, a small erect shrub with yellow flowers, and small trifoliate leaves borne on the apex of a leaf-like footstalk (*phyllodea*) 2 or 3 inches in length, which in the absence of the leaf look like the true leaves of the plant. The leaves, like most other trifoliate leaves, particularly those of *Averrhoa Bilimbi*, collapse during the night and on being touched.

The Geranium Family.

(GERANIACEÆ.)

Succulent, smooth, or prickly-stemmed shrubs, frutlets, or herbs; often gouty and tuberous. Leaves alternate or opposite, simple, lobed, or much divided. Flowers solitary, or in umbels, of showy colours. Sepals 5. Petals 5, equal or unequal; sometimes bilabiate. Stamens 7, 8 to 10 or more (often fewer by abortion) united forming a tube. Pistils 5. Fruit consisting of 5 one-seeded, united nuts joined to a common centre which is prolonged, forming a beak.

Upwards of 500 species are enumerated in this family, the principal genera of which are the *Pelargonium*, native of South Africa, and *Geranium* and *Erodium* of Europe, North Asia, and America. An aromatic resinous principle pervades this family. Their great merit as now cultivated in this country is their handsome flowers, which have been obtained by hybridization. By some persons these showy

flowers are called *Geraniums*, by others *Pelargoniums;* botanically the latter is correct, *Geranium* and *Pelargonium* differing in the form of their flower and number of stamens. In *Geranium* the petals are of uniform size and colour, forming a regular flower with 10 stamens. In *Pelargonium* the petals are of unequal size, and frequently differ in colour, the flower being irregular, the stamens generally 7.

Pelargonium roseum. A native of the Cape of Good Hope, extensively cultivated in some parts of France for the extraction of oil of geranium. It has also been found to produce an acid analogous to œnanthic acid, with which many wines are said to be flavoured. The tuberous roots of some of the species of Cape *Pelargonium* attain a considerable size; those of *P. antidysentericum*, for instance, are as large as a man's head, and are used by the natives for many purposes. These roots are more properly stems (tuber-corms) which vary very considerably in appearance, some being more like corals than land plants. In this country the family is represented by the native species of *Geranium* and *Erodium.*

The Flax Family.

(LINACEÆ.)

Small shrubs or frutlets, perennial or annual. Leaves simple, alternate. Flowers solitary, blue, white, or yellow. Sepals and petals 4 or 5 each, the latter twisted in the bud. Stamens 4 or 5, alternating with dent-like glands. Fruit a dry 4- or 5-valved capsule, with 8 or 10 cells, each containing a smooth flat seed.

About 100 species constitute this family, all widely distributed, and found chiefly in temperate regions, one extending to New Zealand.

Flax (*Linum usitatissimum*). The cultivated flax is a slender, wiry-stemmed annual, attaining the height of about 3 feet, terminating by several pretty blue flowers, succeeded by a 5-valved capsule about the size of a large pea. The cultivation of flax is of great antiquity, fabricated fibre having been found amongst the remains of the pre-historic

lake cities of Switzerland; the mummy-cloth of ancient Egyptian tombs is also composed of flax fibre. According to Pliny flax formed an article of import from Egypt to Greece and Rome. From that time it has been extensively cultivated in the Northern temperate zone, growing as well in Northern Russia as in the hot valley of the Nile. It is cultivated in this country, but more extensively in Ireland; the supply, however, falls far short of the demand, and large quantities are imported from Russia and other parts of Europe, as well as from the United States. The seeds are also an important article of commerce, shiploads being brought from the Russian ports in the Black Sea and from the Baltic for the purpose of obtaining linseed oil. The compressed refuse forms the oil-cake used for feeding cattle. In Scotland flax is called lint. *L. trigynum*, native of East Indies, and *L. arboreum*, of Candia, are pretty yellow-flowered greenhouse shrubs. *L. perenne* is very like the common flax, but has shrublet perennial roots. *L. rubrum* is a showy garden annual, native of Algeria, and *L. monogynum*, a white-flowering perennial, native of New Zealand. Four species of Linum and *Radiola millegrana*, called Allseed, a small trailing shrublet, are the representatives of the family in this country.

The Pink Family.

(Caryophyllaceæ.)

Herbs or soft frutlets, with knotty stems. Leaves opposite, entire, sometimes very small, heath or grass-like, often sheathing or embracing the stem. Flowers solitary, or in spikes or panicles. Calyx consisting of 4 or 5 distinct sepals, or united. Petals 4 or 5, entire or 2-lobed. Stamens 4, 5, 8, or 10. Pistils 2 to 5. Fruit a 2- or 5-valved capsule, rarely a berry.

This extensive family, which consists of more than 1000 species, is widely distributed, abounding in the Northern hemisphere, and in elevated regions within the tropics, being a race of cold-loving plants.

Soapwort (*Saponaria officinalis*). A strong-rooted perennial, with sub-erect, soft, herbaceous stems, 2 to 3 feet in height. It is generally understood to be a native of this country, but is rare, except in gardens. It takes its name Soapwort from its answering to a considerable degree the use of soap, forming a lather in water. It is especially efficacious in taking grease-spots out of woollen cloth.

Gypsophila paniculata. A strong growing perennial, with narrow leaves, attaining the height of 2 feet, the whole having a glaucous hue, which is indicative of its native place, the dry Steppes of Siberia. After having ripened and shed its seeds, the stems become dry and hard, and breaking off entire from the root, are rolled up and blown about by the wind, collecting other matter till they become large balls, called witches.

Cherleria sedoides, called Mossy Cyphel. A native of the mountains of Scotland; is a curious compact moss-like plant, assuming the form of a ball, sometimes a foot in diameter, and being a miniature representative of the Balsam Bog plant of the Falkland Islands.

Corn Cockle (*Agrostemma Githago*). A strong growing annual, with pretty pink flowers, but a very troublesome corn weed; it being difficult to separate the seeds from the grain, the value of the latter is deteriorated, and the flour is even said to be rendered unwholesome.

The family is interesting for its pretty flowers, such as the Carnation and Clove. *Dianthus Caryophyllus*, found wild in this country, by cultivation and hybridizing is the origin of all the beautiful varieties of Cloves and Carnations; and *D. Armeria* that of double Pinks. The beautiful varieties of Sweet William are hybrids of *D. barbatus*, a native of Germany.

The family is represented in this country by 60 species, a great number being mere weeds, such as Chickweed, *Alsine media;* Mouse-ear Chickweed, *Cerastium arvense;* and others. *Arenaria peploides* and *Silene maritima* are pretty sandy-beach plants.

In alliance with the preceding is a small family called *Illecebraceæ*, Knotworts, consisting of about 100 species of small weedy plants, many of them annuals, or frutlet-trailing plants, with pointed stems, and generally opposite leaves, furnished with scarious stipules; the latter being the principal character that distinguishes it from the Clove family. They are chiefly natives of the South of Europe, and of those parts of Africa bordering on the Mediterranean, generally growing in dry and arid places.

Illecebrum verticillatum, *Corrigiola littoralis*, *Herniaria glabra*, and *Polycarpon tetraphyllum*, are natives of this country, but rare; while *Spergula arvensis* (Spurrey), an annual and well-known pest in corn-fields, is common throughout Europe. In alliance with the preceding is the small family *Elatinaceæ*, Water-worts, consisting of about 20 species of small weedy plants, growing in water, widely distributed, and represented in this country by *Elatine Hydropiper* and *E. hexandra*, chickweed-like plants.

The Purslane Family.

(Portulacaceæ.)

Small succulent shrubs, frutlets, or herbs. Leaves generally alternate, rarely opposite, entire, often with hairs at their base. Flowers solitary, terminal, or few, in loose panicles; small, or large and showy. Sepals 2. Petals 5. Stamens variable. Fruit a 1-celled valved capsule. Seeds numerous.

This family consists of about 200 species, widely distributed throughout tropical and temperate countries, generally growing in dry places. They possess no particular properties or uses, except the plant called Purslane.

Portulaca oleracea. A pot-herb of antiquity. It grows freely in this country, and is used as salad. With the exception of the genus *Calandrinia*, which has showy sun-loving flowers, all the others must be considered as botanical curiosities. The Purslane tree, *Portulacaria afra*, is the largest of

the family, being a succulent shrub, with numerous fleshy, oblong leaves, attaining the height of about 3 feet, and of long life, three plants at Kew being nearly one hundred years old.

The only representative of the family in this country is the Water Chickweed, *Montia fontana*, a small aquatic plant, growing in water and in wet places.

THE CABBAGE, CISTUS, AND CAPER ALLIANCE.

The Fumitory Family.

(FUMARIACEÆ.)

Herbs perennial or annual, some climbing. Leaves alternate, soft, generally many times divided, some with tendrils. Flowers solitary, or in spike-like heads. Sepals 2. Petals 4, cruciate, unequal, often ringent. Stamens 4 or 6, distinct, or united in two parcels. Fruit a 1- or 2-seeded nut, or a succulent, many-seeded pod, without valves.

About 100 species constitute this family. They are natives chiefly of the Northern, but sparingly represented in the Southern hemisphere. Many being of a weedy nature, they are readily introduced through commerce into various countries. Several of them are handsome garden flowers, especially *Fumaria* (*Dielytra*) *spectabilis*, a native of China. From the appearance of the flowers of *Fumaria Cucullaria*, it has received the name of breeches-flower, which may also be well applied to *Fumaria spectabilis*. *F. officinalis* is often to be seen growing in great abundance in suburban coal-ash depôts, and similar situations, having the appearance of smoke, when seen at a distance, whence the name Fumewort.

The Cabbage Family.

(CRUCIFERÆ.)

Herbs perennial, biennial, or annual, rarely frutlets. Leaves alternate, generally entire, or variously lobed or divided. Flowers in spikes or racemes. Sepals 4. Petals

4, cruciform. Stamens 6; 4 long, and 2 short. Fruit a siliqua or round pod, with a partition and two rows of seeds. 1600 species are recorded as belonging to this family, of which 350 are found in the middle and south of Europe; they are very generally diffused throughout the Northern, and widely spread over the Southern hemisphere. Nearly 100 are found in North and South America. They possess anti-scorbutic qualities.

Cabbage (*Brassica oleracea*). This is the botanical name of the common white and red cabbage, Savoy, Brussels sprouts, Curly greens, Cauliflower, Brocoli, and all the varieties of what are called cabbages and greens. The solid red and white cabbage, Savoys, &c., are formed of the compact leaves, and the head of Cauliflower and Brocoli is a metamorphosed state of the flower spikes. On looking at the differences individually, and knowing that they have from time immemorial retained their special forms, it may be supposed that they have as good title to be ranked as species as many others. It is, however, considered by most writers that they have all originated from the common wild cabbage, native of the sea-shores of this country and of Europe in general; and that their succulent nature is due to cultivation and selection. But no modern practical experience has yet confirmed this theory; and their having been cultivated in most ancient times makes their origin very questionable. Some of the varieties are said to have been introduced into this country by the Romans. The cauliflower and brocoli were cultivated in France and Italy in the middle of the sixteenth century; and the best seed, it is said, came from the Greek Islands of the Mediterranean.

Turnip (*Brassica Rapa*). A biennial, native of this country and other parts of Europe. By some botanists supposed to be a variety of the preceding, but brought to its succulent state by cultivation. There are several varieties, such as the white and yellow, garden, and field turnip. The Swedish turnip is a well-known hardy variety, in general cultivation for feeding cattle.

Rape (*Brassica napus*), and Colza (*B. campestris*). Two weedy annuals, differing chiefly in the leaves of one being smooth, and of the other hairy. They are extensively cultivated in this country and throughout Europe for their seeds, which yield Rape and Colza oil. The consumption in this country is so great that immense quantities are imported. The refuse seeds form oil-cake for feeding cattle.

Gold of Pleasure (*Camelina sativa*) is a plant similar to the preceding, and cultivated for the same purposes.

Radish (*Raphanus sativa*). A native of China, and recorded as having been grown in this country upwards of three hundred years. It is by some considered a cultivated state of *R. Raphanistrum*, a stringy rooted plant, native of the regions of the Mediterranean. The red and white turnip radishes are mere varieties. *R. caudatus*, or rat-tail radish, a native of India and China, has, within the last few years, been introduced into this country, and has been highly prized and much sought after on account of its long pods, which, under good cultivation, attain a length of 2 to 3 feet. It was supposed that they would supersede the common radish, but such is not the case. They, however, make a good pickle.

Mustard. *Sinapis alba* and *S. nigra* are weedy plants, natives of this country, but are extensively cultivated for the sake of their seeds, which, when ground, form the common mustard; for culinary purposes the seeds are sown thick and cut as soon as the cotyledonary leaves are fully developed. It is used as a salad, with cress (*Lepidium sativum*).

Charlock (*Sinapis arvensis*), a coarse plant growing to the height of 1 or 2 feet, a native probably of Southern Europe, but now widely dispersed, being one of the most abundant weeds, enlivening corn-fields with its yellow flowers. Its presence, however, is a sign of unskilful cultivation. The seeds are used for feeding cage-birds.

Water-Cress (*Nasturtium officinale*). The well-known water-cress is a native of Britain, and is cultivated in the vicinity of all large cities. It is in common use as a salad. A fluid extract, called Liquor Nasturtii, is made from it, and

is of value in cases of scorbutic affections. The water-cress has become naturalized in New Zealand, and grows with such rapidity that it threatens to become troublesome in stopping up water-courses and rivers.

Sea Kale (*Crambe maritima*). A hardy perennial, native of the sandy shores of Britain. It is only within the last hundred years that it has been a cultivated vegetable, and has now become a most useful one, its blanched leaf-stalks being one of the early spring vegetables of this country. It is said to have been pickled and used largely by the Romans for food during sea-voyages.

Horse Radish (*Cochlearia Armoracia*). Although intimately connected with our national dish, roast beef, and although now found wild in many parts, it is doubtful if it is an original native of this country; more probably it was introduced from the Continent. Its tenacity of life in even the smallest portion of its root, causes it soon to establish itself in uncultivated ground.

One of the most remarkable plants of this family is *Pringlea antiscorbutica*, a native of the uninhabited and inhospitable island called Kerguelen's Land, situated in the Southern Ocean, 48° S., where it is a most conspicuous plant, and where only it is found. It closely resembles the common cabbage, being nearly as large, having a firm head and white heart. It is found in great abundance, and is highly valuable as a vegetable to the crews of ships touching there. It is chiefly distinguished from cabbage by the nature of its seed vessels and seeds. Another plant of the Southern hemisphere possessing similar properties is *Lepidium oleraceum*, a native of the shores of New Zealand, which proved of high value to the first voyagers, and has now become a cultivated pot-herb.

Woad (*Isatis tinctoria*). A biennial, attaining the height of 3 or 4 feet, and found wild throughout Europe. It has been long famed for a dye, obtained from the leaves. Woad was known to the ancients, and it appears from Cæsar's account that it was probably with the juice of this plant that

the ancient Britons painted their bodies. Since the introduction of indigo it has fallen into disuse, except with woollen manufacturers, who use it mixed with indigo.

Isatis indigotica. A native of China, and, like the above, yields a blue dye.

As a curiosity, what is called Cow or Jersey cabbage may be here noticed, being like the common cabbage, of which it is a variety, but growing on a stem, sometimes attaining the height of 12 or 13 feet, which is formed by continually stripping off the lower leaves. The stems are quite firm and hard, and are made into walking-sticks that are lighter even than cork; the only true shrubs of the family are *Vella Pseudo-Cytisus*, native of the South of Europe, having yellow flowers, and several species of *Iberis* (Candytuft), which have woody stems, forming low bushes 1 to 3 feet high.

Rose of Jericho (*Anastatica Hierochuntina*). An insignificant annual, consisting of several small-branched stems, 4 to 6 inches in length, rising from a tap-root and at first lying prostrate. It is a native of Syria, Egypt, and North Africa, growing in dry, desert places. After the seeds are perfected the stems become dry, hardened, and incurved, meeting each other and forming a hollow, skeleton-like ball, which by the force of the wind is loosened and blows about the desert. Upon the application of moisture it again expands, retaining this property for many years. It grows abundantly in the regions about Jericho, and is held in a degree of superstitious sacredness by the natives, but it is difficult to explain why it has received the name of Rose of Jericho, as it is as unlike a rose as a cabbage. In this country it was kept as a curiosity, but it is now superseded by its more elegant rival, the Resurrection plant, which see.

The following are common showy garden plants:—Rocket (*Hesperis matronalis*); Wallflower (*Cheiranthus Cheiri*); Ten-Week Stock (*Matthiola annua*); Gilly Flower or Brompton Stock (*Matthiola incana*); Yellow Alyssum (*Alyssum saxatile*); Purple Alyssum (*Farsetia deltoidea*); and different kinds of Candytufts and Arabis.

The Rock Rose Family.

(CISTACEÆ.)

Small shrubs, frutlets, or herbs. Leaves opposite, alternate, entire, broad or heath-like. Flowers showy, solitary, or in loose panicles. Sepals 3 or 5, persistent, twisted. Petals 5, crumpled in the bud, and twisted in a contrary direction to the sepals. Stamens numerous, seldom few. Fruit a 3-, 5-, or 10-valved capsule, generally numerous.

Nearly 200 species are enumerated in this family, the greater number being natives of the South of Europe, Western Asia, North of Africa, and islands in the Mediterranean; rarely in other parts of the world.

Gum Ladanum (*Cistus creticus*). A native of Crete and other islands of the Mediterranean; it produces the gum called Ladanum, which is collected during the heat of the day, by trailing or tossing a bunch of leather thongs over the bushes, to which the gum adheres. It is also collected from the beards of goats which browse amongst the plants.

Gum Cistus (*Cistus ladaniferus*). This is the beautiful gum cistus of the gardens. It is a native of Spain, Portugal, and islands of the Mediterranean. A gum exudes from the leaves, and is collected in the same manner as the preceding. Both were formerly employed in medicine, but are now not much used except in perfumery, and more especially by the Turks, who chew it and use it in various preparations.

Rock Rose (*Cistus Helianthemum*). A pretty little evergreen shrub, with yellow flowers, native of cliffs and rocky places in this country. There are many varieties cultivated in gardens, with double and different coloured flowers. Their stamens are peculiarly elastic; on being pressed together they resume their original position so quickly that the eye almost fails to detect the movement.

In alliance with the preceding is the genus Cochlospermum, consisting of about a dozen species of shrubs or small trees, natives of the tropics. They have large showy yellow cistus-

like flowers, but differ entirely in habit from Cistaceæ in having alternate palmate leaves, also in the seeds being enveloped in a fine white wool-like filament.

Cochlospermum gossypium. A native of the peninsula of India. A gum called Kuteera is obtained from the stem, which is used as a substitute for gum Tragacanth. The cotton-wool of the seed-pod is sometimes used for stuffing pillows, &c. One species, native of Sikkim Himalaya, is a tree remarkable for its thick, awkward-spreading branches, bearing on their apex clusters of large showy yellow flowers. Its leaves are made into a curious rude kind of bellows, with which the natives of the Kymore hills smelt iron. A pair of these bellows may be seen in the Museum at Kew.

The Mignonette Family.

(Resedaceæ.)

Herbs, rarely soft-wooded frutlets, with alternate, entire, or divided leaves. Flowers irregular, in spikes or racemes. Petals 5 or 6, lacerated, lateral, on a disk. Stamens 10 to 20. Fruit an open membranaceous urceolate capsule, or sometimes fleshy, many-seeded.

About 40 species constitute this family of weedy-looking plants, natives chiefly of Europe and the shores of the Mediterranean, a few being found in India, the Cape of Good Hope, and California.

Weld (*Reseda Luteola*). A single-stemmed annual, native of this country, at one time much cultivated for the dye it afforded, which, according to the different mordants employed, was either green, yellow, or blue; it is chiefly used in colouring paperhangings: the colour called Dutch pink is also obtained from it.

Mignonette (*Reseda odorata*). This favourite plant is a native of Egypt and the shores of the Mediterranean, and has been cultivated in this country for rather more than one hundred years. It was in high repute with the early Romans as a charm for healing wounds. In this country it is an annual, but in the South of Europe it becomes shrubby.

The Caper Family.

(Capparidaceæ.)

Trees, shrubs, ampelid climbers, frutlets, or herbs. Leaves alternate, simple, trifoliate, or digitate. Flowers solitary, spicate, or racemose. Sepals 4, distinct or united. Petals 4 or 8, equal or unequal. Stamens generally numerous. Fruit fleshy, pod-like, or globose, sometimes berry-like, borne on a gynophore.

About 350 species are recorded of this family, which are widely distributed, being chiefly tropical; many of them pos sess poisonous qualities.

Caper (*Capparis spinosa*). A stiff prickly-branched shrub, with simple deciduous leaves. It is a plant of the desert throughout Western Asia, Egypt, Northern Africa, and Southern Europe, growing in rocky places, and often seen on old and ruined city walls. It is extensively cultivated in France and other parts of the South of Europe for its flower-buds, which are collected before expansion, and, preserved in vinegar, form the capers of commerce.

Capparis Sodada is a remarkable bush, occupying large tracts of Central Africa, marking the transition from the desert to the more fertile regions of the South, and prevailing especially in Timbuctoo. The currant-like fruit is eaten fresh as well as dried. The burnt stems yield a salt.

Capparis ferruginea. A narrow rusty-leaved shrub, native of the West Indies. In Jamaica it is called the Mustard shrub, its berries being pungent like mustard.

Cratæva Tapia. A tree, from 20 to 30 feet high, native of the West Indies. The fruit has a strong smell of garlic, and it is therefore called the Garlic tree of Jamaica.

THE MOONSEED AND VINE ALLIANCE.

The Moonseed Family.

(Menispermaceæ.)

Climbing shrubs, generally twiners, rarely herbs. Leaves alternate, entire or lobed. Flowers inconspicuous, usually

in spike-like racemes, unisexual or bisexual; the several parts of the flower varying much in number and position in different sexes. Fruit a small fleshy drupe.

About 300 species are enumerated of this family, natives chiefly of tropical countries. *Menispermum canadense*, is, as its name implies, a native of Canada. They possess a bitter principle — some being tonic, others narcotic, and even poisonous. Some are used for the cure of snake-bites.

Calumba root (*Jateorhiza Calumba*). A native of the east coast of Africa, and a considerable article of trade at Mozambique. It is not cultivated, but is found abundantly in the thick forests fifteen or twenty miles inland. The roots may be compared to Parsnips, but are more cylindrical, and grow in clusters slantingly in the ground. They are dried, cut into slices, and are of a yellowish colour. In this state they form the *Calumba root* of commerce, much prized for its medicinal qualities.

False Calumba root (*Coscinium fenestratum*). A native of Ceylon. The stem varies from 1 to 4 inches in diameter, is very porous, and of a yellow colour. Some years ago a large quantity was imported to London, cut in slices, and sold as Calumba root; but its hard and woody texture readily distinguishes it from the true Calumba root. A yellow dye is extracted from it.

Cocculus suberosus. A native of the East Indies, the seeds of which are the true *Cocculus indicus* of the shops, employed for destroying vermin. They are extensively imported into this country; but it is difficult to account for their use, unless they serve to adulterate or "drug" fermented liquors, as frequently reported. Brewers are liable to a penalty for having them on their premises. The plant is also called *Anamirta cocculus* and *A. paniculata*.

Bauna root. This is supposed to be a species of *Menispermaceæ*. It is a native of the upper regions of the Amazon, Rio Negro, and other places, and has round tuberous roots like turnips, but of large size, some weighing nearly 50 lbs. It is highly poisonous when fresh, but after

repeated macerations yields an excellent tapioca, which constitutes a great part of the food of the Indians.

The family *Schizandraceæ* consists of about a dozen species, natives chiefly of India and Japan. They are trailing or twining climbers.

Kadsura japonica yields, by boiling, a mucilage used in Japan for paper-making. They are handsome creepers; several species have been long cultivated at Kew.

Another family, *Lardizabalaceæ*, consists of a dozen species, having alternate trifoliate or digitate leaves. Flowers small, unisexual or bisexual. Fruit a berry.

About a dozen species are enumerated of this family, chiefly natives of the cooler parts of India, Chili, and South America. The juicy fruit of some of them is eaten, especially of *Decaisnea insignis*, native of Bhotan, where it is eagerly sought after by the natives. It is thought that it would even be hardy and fruit in this country. *Stauntonia latifolia*, of India, and *Lardizabala triternata*, live in the open air in this country, and are handsome evergreen climbers.

The Grape Vine Family.

(VITACEÆ.)

Trailing and climbing ampelids, some rising from a gouty base. Leaves usually alternate, entire, lobed or digitate. Flowers small, in spikes or panicled racemes. Fruit a pulpy berry, containing one or more seeds.

About 300 species are recorded of this family, chiefly natives of the warmer regions of both hemispheres, some growing to a great length, and adhering to trees by their claw-like tendrils.

Grape Vine (*Vitis vinifera*). The fruit is a berry, growing in bunches, and called Grapes. The chief manufactured products of the grape are wine and brandy; the former obtained from the juice by fermentation, the latter by distillation. From the history of Noah we learn that the vine was cultivated, and wine made at a very early period. The

great wine and brandy producing countries now are France, Spain, and Portugal, from whence the chief supplies come to this country. The different qualities of wine are due to differences of soil, climate, mode of manufacture, and partly to the various kinds of grapes. The vine was introduced into England by the Romans, and appears to have been extensively cultivated by the Monks for wine-making; but on account of the uncertainty of the seasons it has long ceased to be cultivated for that purpose. It is extensively grown in hothouses, and the large luscious fruit of many fine varieties is used for dessert. The vine attains a great age; that at Hampton Court is one hundred years old, and covers a surface of 2200 square feet. Raisins are the dried berries, and come to this country chiefly from Spain and Portugal. Currants (a corruption of Corinth) are a small variety, coming from Zante, and other islands of the Greek Archipelago.

Virginian Creeper (*Ampelopsis hederacea*) is a well-known climbing plant, useful for covering walls and arbours, to which it clings by its tendrils, and is very beautiful from its leaves turning red in autumn. It is a native of North America, and by some called American Ivy and Fingered Ivy.

Cissus discolor, and others, are well-known ornamental hothouse creepers, the first being a native of Java. Some have singular stems. *C. planicaulis*, a native of Sikkim-Himalaya, has flat, broad stems, climbing to a great length over trees, and presenting the appearance of machinery bands. The stems of *C. Livingstonia* have a golden-brown, pile-like appearance, and look as though cut out of copper. Several species, such as *C. macropus* and *C. Bainesii*, have thick gouty stems, looking like a large mangold-wurzel above ground. The first two are natives of Angola, and the last of Namaqua Land, the localities where the remarkable Welwitschia has been found.

THE MAGNOLIA AND CUSTARD APPLE ALLIANCE.

The Magnolia Family.

(Magnoliaceæ.)

Splendid trees or shrubs, evergreen or deciduous. Leaves alternate, entire, rarely lobed, some with pellucid dots. Flowers solitary, often large and showy. Sepals 3 or 6, deciduous. Petals 3, 9, or numerous; often large, thick, and fleshy; imbricate. Stamens free. Fruit consisting of numerous carpels, generally united and arranged in a circle, capsule-like, or on an elevated axis, each appearing like a follicle containing 1 or 2 seeds.

Seventy or more species are described as belonging to this showy and fragrant-flowering family. In North America they are chiefly deciduous. Several species are also found in the East and West Indies, China and Japan. They are represented in Australia by *Tasmannia*, and in South America by *Wintera*. None have been found in Africa.

Tulip Tree (*Liriodendron Tulipifera*). A noble tree, native of North America, attaining the height of 80 feet or more, with a diameter of 4 feet. It has 3-lobed leaves, and produces a profusion of yellow flowers of a tulip-like form. The wood is hard and durable, takes a good polish, and is used for many purposes. In this country it attains a large size, two specimens at Kew, more than one hundred years old, being 70 feet high. *Magnolia acuminata*, *M. macrophylla*, *M. cordata*, *M. auriculata*, and *M. tripetala*, are small deciduous trees, natives of North America and hardy. *M. macrophylla* has the largest simple leaf of any tree growing in the open air in this country. *M. glauca*, also a native of North America, is a handsome branching tree, 20 feet or more in height, having elliptical leaves, silvery on the under side, and well known for its fragrant flowers. In the United States it is called Swamp Sassafras. The bark and seeds are aromatic and pungent, and are used medicinally.

Magnolia grandiflora. A native of Carolina, and one of the most conspicuous of trees, sometimes attaining the height of 80 feet or more. It is an evergreen, and has firm elliptical leaves from 8 to 10 inches long, smooth and shining on the upper surface and of a rusty brown on the under. The flowers are of a yellowish-white colour, and stand upright in the form of a cup, 6 to 8 inches in diameter; they are highly fragrant, and are the largest flowers of any tree seen in the open air in this country. There are several varieties, some of which are not so hardy as others. One tree at Kew, more than one hundred years old, for many years growing against a wall, but now for more than twenty years standing fully exposed, has attained the height of 23 feet, and a girth of 3 feet.

Magnolia conspicua. A tree, native of China, where it is called "Youlan." It is deciduous, and attains the height of 40 or 50 feet, being very much branched, and having large pure white lily-like flowers, which are produced before the leaves expand, and in such profusion as to appear at a distance one compact sheet of white. It was introduced in 1789, and one of the original plants is still growing at Kew.

Michelia Champaca. A large tree, native of India and Burmah, where it is cultivated for its fragrant yellow flowers, and is an object of veneration with the Hindoos. The bark is said to possess medicinal properties. *M. Cathcartii* and *M. excelsa* are large trees, natives of Nepal and Sikkim Himalaya. They have large white flowers, which are produced before the leaves, and, where the trees are numerous and contiguous, present the appearance of a snow shower having fallen. *Magnolia Campbellii* is another lofty tree, native of the same region. It has large red flowers, which are very conspicuous; plants of it have recently been introduced at Kew.

Winter's Bark (*Drimys Winteri*). A native of Terra del Fuego, and extending northward through Chili. It has beautiful smooth leaves of an oblong lance form, generally silvery white on the under side. The bark was brought

into repute by Captain Winter, as an antiscorbutic, as long ago as 1579, he having found it very efficacious in cases of scurvy amongst his crew. Other remedies, however, having since been discovered, it has fallen into disuse.

Star Anise (*Illicium anisatum*). An evergreen shrub, native of China, attaining the height of 8 or 10 feet. It derives its name from the carpels of the fruit being united in a circle, and rayed like a star. It is highly aromatic, and is in great repute in China and other countries of the East, where it is used as a condiment with food, and is imported to Europe for the same purpose; in France, liqueurs are flavoured with it. It also yields an aromatic oil, used for flavouring, and in perfumery. *I. religiosum* is a pretty evergreen shrub, native of Japan, held sacred by the Japanese. *I. floridanum* is a shrub, native of Florida, also possessing aromatic qualities.

Tasmannia aromatica. A native of Mount Wellington in Tasmania. It is a shrub, or rugged, often distorted, branched small tree, attaining the height of 10 or 12 feet. Its bark has properties similar to those of Winter's Bark. Its berries, being pungent, and used as a substitute for pepper, it is called by the Tasmanians the Pepper Plant.

The Custard Apple Family.

(ANONACEÆ.)

Trees, shrubs, or climbers. Leaves alternate, simple, entire, furnished with deciduous stipules. Flowers solitary, or usually 2 or 3 together, some unisexual. Sepals 3. Petals 6, in two rows. Stamens generally numerous, free. Fruit dry or succulent, consisting of many united carpels, each containing a single seed.

Above 300 species are enumerated of this family, being natives chiefly of tropical climates, a few extending beyond. They are chiefly valued for their fruits.

Cherimoyer (*Anona Cherimolia*). A tree, native of Tropical America, and cultivated in Peru and other parts for

its fruit, which is considered by some to be one of the finest in the world. Like other cultivated fruits there are several varieties, varying in size and colour, also in having few or many seeds. Several species of *Anona* are cultivated in other parts of Tropical America and the West Indies, as well as in tropical countries of the East, of which the following are the principal.

Sweet Sop (*Anona squamosa*). This bears a somewhat egg-shaped fruit, about 3 or 4 inches in diameter, covered with tubercles, having a cream-coloured spongy pulp. In the West Indies it is called sugar apple, or sweet sop, and is much esteemed.

Sour Sop (*Anona muricata*). A similar fruit to the preceding, but larger, sometimes weighing 2lbs.; it is covered with short blunt prickles, and is esteemed by the negroes, but is not much liked by Europeans.

Custard Apple or Bullock's Heart (*Anona reticulata*). Also a large fruit having a netted skin, containing a yellowish or slightly red custard-like pulp. The above are all small trees, averaging from 20 to 30 feet in height.

Anona triloba. A small tree or shrub found abundantly throughout the Southern United States of North America. The fruit is about 3 inches in length, enclosing a yellow, sweet, luscious pulp, but is not much esteemed. Hogs fatten on them.

Duguetia quitarensis. A tree, native of Guiana, seldom attaining more than 20 feet in height. Its wood is tough and elastic, and is imported into this country under the name of Lance Wood.

Xylopia aromatica. A tall tree, native of Western Tropical Africa. It has pointed egg-shaped leaves, woolly underneath; the fruit consists of a number of dry carpels, about two inches in length, which are aromatic and used as pepper, being sometimes called Guinea Pepper, Negro Pepper, and, by old authors, "Piper Æthiopicum."

(DILLENIACEÆ.)

Trees or small shrubs, sometimes twiners, rarely herbs. Leaves alternate, rarely opposite, in the trees large, with strong lateral, parallel veins, often articulated with the petiole, which is permanent, after the leaf has fallen; in some the leaves are very small, even heath-like. Flowers yellow, solitary, or in terminal racemes. Sepals and petals 5 each. Stamens numerous, free, or united in several parcels. Fruit capsular; dry or succulent.

About 200 species are enumerated of this family, natives chiefly of India and Australia; they are also represented in Tropical America; but few are found in Africa.

Dillenia speciosa. A handsome tree, with large ribbed leaves, native of India, and of the Malay Islands. The wood is hard and tough, the fruit and calyx are fleshy, being of an acid flavour, and used by the natives in cooling drinks, curries, and the like. The fruit of *D. scabrella*, a smaller tree, is used for the same purposes.

Another species, *D. pentagyna*, is also common throughout India, and remarkable for its large leaves, which, in young trees, sometimes measure as much as 4 or 5 feet in length.

Wormia excelsa. A large tree, native of Java and the Malayan Peninsula. It has a hard wood, which is compared to oak.

Tetracera potatoria. A climbing plant, native of Sierra Leone. It is called the Water Tree, on account of its stem when cut yielding a quantity of water.

Delima sarmentosa. Also a climber, widely distributed, from Ceylon, throughout India, eastward, and through the Malay Islands. The leaves are from 2 to 5 inches long, and are in common use as sand paper. The Australian section is represented in the greenhouses of this country by species of *Hibbertia*, *Candollea*, *Hemistemma* and others, *Hibbertia volubilis* being an old inhabitant, and well known for its large yellow fœtid flowers.

THE ACONITE AND POPPY ALLIANCE.

The Aconite Family.

(RANUNCULACEÆ).

Herbs, shrubs or climbers. Leaves opposite or alternate, more or less divided, rarely entire, their footstalks sheathing, in some stipulæform. Flowers solitary or generally in paniculated racemes. Sepals 3—6. Petals 3—5, or many, equal or unequal; often with a gland or nectary-formed base. Fruit consisting of one or many follicles (or achenia), rarely pulpy, berry-like.

About 1000 species compose this family, natives of temperate regions of both hemispheres, or in elevated regions within the tropics; they abound in Europe. The whole family are acrid and poisonous, some containing the most virulent of vegetable poisons.

Aconite, Wolf's-bane, or Monkshood (*Aconitum Napellus*). A doubtful native of Britain, but, on account of its showy blue flowers, is a favourite in cottage gardens. It is poisonous in the highest degree, many fatal accidents having occurred through eating the leaves for parsley, but more especially from using the roots in place of horse-radish. The chemical alkaloid called Aconitine is obtained from the roots of this plant.

Aconitum ferox. A native of Nepal; the Bish or Bikh of the natives. It exceeds the above in virulence, and is considered the most formidable poison in India. Other allied species, natives of the Himalaya, are likewise strong poisons. The Indians use them for poisoning the arrows, with which they shoot tigers, the least wound causing certain and early death.

Aconitum lycoctonum. A showy yellow-flowered species, native of the North of Europe, especially Lapland, where it grows in abundance. It is also poisonous, and is naturally avoided by all animals.

Larkspur (*Delphinium*). The perennial species of *Delphinium* are similar in growth to Monkshood. *D. grandiflorum*, *D. intermedium*, *D. exaltatum*, *D. sibiricum*, *D. chinense*, and *D. formosum*, are ornamental plants, with showy flowers, as is also the well-known garden annual, *D. consolida*, called Branching Larkspur.

Stavesacre (*D. staphisagria*). A native of the South of Europe and the Levant. Its seeds are of a nauseous bitter taste, and are held in repute for the cure of many diseases. Their virtues are due to an alkaloid, which is a powerful and acrid poison.

Black Hellebore (*Helleborus niger*). The Christmas rose, as its name implies, flowers in December and January, and is conspicuous at that season (when mild) for its large white flowers. It is a native of Germany and Italy. The roots are black, and about as thick as the finger; they have been held in high repute, in ancient as well as in modern times, for the cure of many diseases, being a strong drastic purgative, but dangerous when used in over doses.

Stinking Hellebore (*Helleborus fœtidus*). A native of Britain, but rare. It is a strong-rooted perennial, possessing a disagreeable odour, and acrid poisonous properties; it has been employed as a domestic medicine, but is highly dangerous; instances are on record of domestic animals being poisoned with it.

Green Hellebore (*Helleborus viridis*). A plant similar to the last, native of Britain, and considered the true officinal hellebore of the druggists. Large quantities of its roots are yearly brought to London, and used in medical practice.

Pile-wort (*Ranunculus Ficaria*). A pretty yellow flowering plant, with heart-shaped leaves, not exceeding 3 inches in height, native of this country, growing abundantly in moist shady places. After flowering it disappears, but after heavy rains its place is well marked by the exposure of the numerous little tuberous roots lying on the surface like grains of wheat, which have been supposed by the ignorant to be corn fallen from heaven. This is particularly the

case in Silesia, where they are gathered and used as food, being very mealy, and not unwholesome when boiled.

Water Crowfoot (*Ranunculus aquatilis*). A native of this country, and, as its name implies, growing entirely in water, occupying ditches, rivers and ponds to a great extent, giving the surface a gay appearance with its pretty white flowers. It has leaves of two kinds, the floating ones being like little round shields, and the submerged ones fine and thread-like. This is one of the few wholesome species of the family. In some parts of England cows are entirely fed on it during the winter; they, as well as horses and hogs, eating it greedily.

Water Celery (*Ranunculus sceleratus*). An annual, native of Britain, growing abundantly in ditches and wet places. It is something like celery, but highly acrid, blistering the mouth and skin, and is said to be used by beggars for making artificial sores. In Scotland the same use is made of the Lesser Spearwort (*R. Flammula*), but wounds so made often become incurable.

Ranunculus acris, *R. bulbosus*, and *R. repens*, are common British plants, enlivening woods and meadows in the month of May with their brilliant yellow flowers, called king cups and gold cups, and are supposed to be the "cuckoo buds of yellow hue" of Shakspeare. Like the preceding they are acrid and blistering, often inflaming the mouths of cattle, as does also the annual Corn Weed (*R. arvensis*).

Marsh Marigold (*Caltha palustris*). A beautiful plant, growing abundantly by river-banks and marshy places. It is commonly reputed to be acrid and poisonous. The flower-buds have been used as capers.

May-Apple or Duck's-Foot (*Podophyllum peltatum*). A native of the United States, where it is found in great abundance growing in damp shady woods. It has large shield-like lobed leaves and white flowers; its fruit is egg-shaped in form and about the size of a small lemon. The root and leaves of the plant are acrid and poisonous, but the pulp of the fruit is less so, and contains active medicinal qualities,

being in repute as a substitute for mercury. It is also known by the name of mandrake.

Fennel Flower (*Nigella sativa.*). An annual, about a foot or more in height, native of the South of Europe, Egypt and Western Asia. It has finely-cut leaves, and is cultivated in some parts for its seeds, which are hot and peppery, and are used as a condiment in cookery. With the Egyptian ladies they are in repute for improving the complexion. The seeds of this or an allied species are supposed to be the Black-cummin or Fitches of Scripture.*

N. Damascena. A garden annual, well known by the names of "Devil in a Bush," and "Love in a Mist." Its properties are similar to those of the preceding.

Yellow Root (*Xanthorhiza apiifolia*). This is one of the few shrubby species of the family, being a low bush with finely-cut leaves and inconspicuous flowers. It is a native of North America, where it has obtained some degree of medicinal reputation, and is hardy in this country.

Pæonia is a genus of showy flowering plants, which with one exception are all strong-rooted herbaceous perennials. *P. officinalis*, the double Peony, well known in every garden, is said to be a native of Switzerland, but has been cultivated in this country for more than three hundred years. *P. albiflora*, native of Siberia, is similar to the last, but has double white flowers. *P. fragrans*, native of China, has large double red flowers, but differs from *P. albiflora* in being scented like a rose. *P. moutan*, the Tree Peony, is a shrub, also native of China, and hardy in this country. It attains the height of three or four feet, and has large bluish-coloured flowers; it was introduced in 1789.

Within the last few years a number of new varieties with showy coloured flowers have come into cultivation.

Virgin's Bower (*Clematis Vitalba*). A native of this country, growing, and climbing over hedges, bushes, and trees, and in common use for forming rustic arbours. It is also called

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* Isaiah chap. xxviii. ver. 25-27. Ezekiel chap. iv. ver. 9.

"Traveller's Joy" and "Old Man's Beard," the latter name being given to it on account of its hoary appearance throughout the winter, owing to a feathery appendage of the seeds. Like others of the family it is acrid, and blisters the skin. It is the only shrubby representative of the family in this country. The slender stems are tough and used for many domestic purposes. *C. Sieboldtii*, *C. cærulea*, and others, natives of Japan, are large showy flowering creepers, hardy in this country; while *C. aristata*, *C. glycinoides*, *C. coriacea*, and others, are showy greenhouse creepers.

The Flask Leaf Family.

(SARRACENIACEÆ).

Perennial herbs. Leaves hollow, tubular, from 6 inches to more than a foot in length, bearing the lamina on its apex, in the form of a lid. Flower-stalk a scape, generally bearing 1, or sometimes 2 or more flowers. Sepals 4—5—6. Stamens numerous. Pistil simple, leafy, truncate, or expanded into a broad circular shield with 5 stigmas, in the form of pores, on its margin. Fruit a capsule, seeds numerous.

A small family of plants, consisting of not more than 10 known species, with one exception natives of North America. They grow in swampy places, and are remarkable for their hollow leaves, which are generally upright, and rise from a central crown, or a creeping stem. They are tubular, and have a lid resembling the pitcher-plant of India, the width of the mouth being from 1 to 2 inches in diameter. The inside of the tube is lined with curious hairs, and it generally contains liquid that seems to entice insects, many perishing in the fluid, which ultimately becomes putrid. The pistil of *Sarracenia* is curious, being in the form of an open umbrella, with the stigmas at the angles on the under side of the margin. It is called "Side-saddle Flower," from the petals hanging down between the sepals of the calyx like a lady's riding-dress.

Heliamphora nutans is a native of British Guiana. In another species of the family, *Darlingtonia Californica*, a native

of California, the pitchers are at the apex of a flat leaf, and inverted; in size and appearance they resemble Jargonelle Pears, and are used by the natives as fly traps. The pitchers of *Sarracenia purpurea* are spotted, as though marked with small-pox, and it is singular that it has been used by the Indians as a cure for that disease, and has been tried in this country for the same purpose, with some fancied degree of success.

The Poppy Family.

(PAPAVERACEÆ.)

Herbs or rarely shrubs, generally with milky juice. Leaves alternate, entire, lobed or deeply gashed, without stipules. Flowers solitary on long stalks, showy, rarely small, and paniculate. Sepals 2 or 3, deciduous. Petals 4 or 6, crumpled in the bud. Stamens numerous. Style short or absent, with a rayed stigma only. Fruit long, siliquiform, 1-celled, or capsular and many-celled, opening by pores at the apex. Seeds numerous. The genus *Bocconia* is an exception to the general rule, in having panicles of small flowers without petals.

This family consists of 100 species or more. They abound in Europe, extending sparingly eastward into Northern Asia and Japan. Some are also found in Tropical America, but they are scarce in the Southern hemisphere, and in some instances may have been introduced by commerce. They contain a narcotic milky juice, in some of a yellow colour.

Poppy (*Papaver somniferum*). An annual, attaining the height of 3 feet, having large, single white or pink flowers. Its native country is not known, as it has been cultivated from the most remote ages, and was early known in Italy and Greece. It has long been extensively grown in India for its milky juice, which is obtained by scarifying the capsules when full grown, but in a green state. The juice soon hardens, is scraped off, formed into balls, and called Opium, from which morphia is obtained. The highly medicinal properties of morphia are well known, and when used with judi-

cious care it is one of the most valuable medicines to man. Opium is, however, more extensively used for inducing narcotic intoxication by smoking or chewing, particularly in China, Turkey, Persia, India, and Siam, and to some extent in England. This pernicious custom, when carried to excess, is fatal to health, even causing madness. The capsules or poppyheads are dried and employed in fomentations, and a syrup is prepared from them for use as a cough medicine. Opium forms one of the ingredients of Godfrey's Cordial. The seeds are perfectly free from any narcotic principle. A fine clear oil, nearly equal to olive-oil, is obtained from them, which is used as salad-oil in India as well as on the Continent, where it is expressly grown for that purpose. It is but sparingly cultivated in this country for its heads, the seed being the maw-seed given to cage-birds. The Government of China, being desirous to prevent the use of opium, destroyed a great quantity, the property of British merchants, which led to the first war with that country. The result being the opening of that great empire, as also Japan, to the trade and commerce of the world. The Poppy, therefore, with the Tea, Sugar, Tobacco, and Cotton plants, have been important agents in changing the political and social conditions of nations. An import duty on tea led to the separation of the North American Colonies from the British Crown, which have become the great Republic of the United States. The cultivation of sugar, tobacco, and cotton in America and the West Indies, laid the foundation of the slave trade, with all the horrors that have attended it.

Field or Red Poppy (*Papaver Rhœas*). Although this is one of our most beautiful British plants, and a great ornament to our corn-fields, it must nevertheless be viewed as a troublesome weed. It also adorns waste banks and cliffs. A syrup is prepared from the petals called "Syrupus Rhœados," a colouring matter used in the preparation of red ink.

Horn Poppy (*Glaucium luteum*). A strong-rooted perennial, growing on the sandy shores of this country as well as

on the coasts of continental Europe and North America. Like most seaside plants, it is of a glaucous hue, having showy yellow flowers, succeeded by seed-pods 4 or 5 inches in length, curved like horns.

Celandine (*Chelidonium majus*). A bushy perennial, with small yellow flowers, attaining the height of 2 feet, native of Britain, found throughout Europe, and introduced into North America. The whole plant contains a thick juice of a yellowish colour, which is employed by rustics for removing warts, &c.; diluted with milk it is used as an eyewash.

Sanguinaria Canadensis. A pretty herbaceous plant, native of North America, not more than 6 inches high, producing showy white flowers early in the spring. It has thick branching roots, which yield a yellow pigment, used as a dye; also by the Indians to colour their bodies, and for rude paintings.

Papaver orientale and *P. bracteatum*, strong-growing perennials, natives of Asia Minor, are showy garden plants with red flowers, and are with Peony the largest-flowering herbs grown in the open air in this country.

THE WATER LILY AND SACRED BEAN ALLIANCE.

The Water Lily Family.

(Nymphæaceæ).

Aquatics, growing in deep water, having a thick creeping or erect bulb-like rhizomat. Leaves heart-shaped or circular, floating on or growing above the surface of the water. Flowers solitary, on a long scape, large and showy. Sepals 4 or 5. Petals numerous, decreasing in size towards the centre, and becoming stamens, which are also numerous, and with the petals seated on a disk, in some forming a tube. Pistil 1, with a rayed stigma, or wanting, with the stigmas lining the tube (as in Victoria). Fruit capsule-like, without valves, containing numerous seeds.

About 50 species are enumerated of this family, being chiefly natives of the warm regions of the Northern hemisphere. Three are natives of Britain; they are sparingly found in South Africa, and are represented in Queensland by the magnificent *Nymphæa gigantea*, and by *Victoria regia* in Tropical America.

Water Lily (white), *Nymphæa alba* (yellow), *Nuphar lutea*, natives of this country, and common throughout Europe. *Nuphar advena* is a native of North America; its seed-pods (so called) are an important article of food to the Indians, who collect them in large quantities and keep them for winter use. *Nymphæa cærulea*, *N. rubra*, *N. dentata*, *N. gigantea*, and others, are cultivated in the gardens of this country, being well known for their beautiful flowers; also *N. thermalis*, a white flowering species found in Hungary which appears to be the same as the *N. Lotus* of the Nile. It is common in India, where it is held sacred, likewise in Egypt, where it is found rudely sculptured on the ancient idols.

Gorgon plant (*Euryale ferox*). A native of India, having circular leaves 2 or 3 feet in diameter, lying flat on the water, being very prickly and horrid-looking on their upper surface. It has prickly fruit, about the size of a small orange, containing black seeds the size of peas, which are full of albumen, and are used by the Hindoos and Chinese for food. It is said to have been cultivated in China for upwards of three thousand years.

Victoria Lily (*Victoria regia*). This remarkable plant was first discovered by a German botanist in 1801, afterwards by several others in different parts of Tropical America. It was not, however, brought into special notice till discovered by Sir R. Schomburgk in British Guiana in 1837, and introduced at the Royal Gardens, Kew, in 1847. On account of its remarkable appearance it has yearly excited public curiosity. In its native country it is a perennial, having a long under-water rhizomat, like the white water lily. In this country it seldom lives through the winter, but is readily grown from seeds each year. The plant consists of a crown

producing leaves and flowers. The leaves when full grown measure 6 or 7 feet in diameter, and are perfectly circular, with the margin turned up about 2 inches, resembling a large tray. The under side is full of raised ribs, and very prickly. They are attached by their centre to a stalk which, when full grown, is often not less than 10 feet in length, and about the thickness of the finger. The leaves are produced in succession round the crown from right to left, each, when the plant is perfect, producing a flower-bud in its axis which gradually rises on a stalk to the surface, opening in the afternoon. The flower consists of numerous petals of a pure white, and when fully expanded is from 10 inches to 1 foot in diameter; it then emits a powerful and pleasant odour. During the morning of the next day it partially closes, expanding again in the afternoon, the colour then being pink, and on the third day it finally closes and withers.

This and *Cereus Macdonaldiæ* are the most magnificent of flowers, even rivalling *Magnolia grandiflora.*

The Water Bean Family.

(Nelumbiaceæ).

Aquatics, with large round peltate leaves, floating on, or rising above the surface of the water, and produced from a fleshy rhizomat. Flowers solitary on a scape equal in height to the leaves. Sepals 4 or 5. Petals numerous. Stamens numerous, seated below an elevated spongy receptacle (or torus). Ovaries numerous, embedded in the apex of a large spongy receptacle, becoming a very hard nut.

This family consists of probably not more than three species, natives of India, China, Jamaica, and some parts of America, and have lately been discovered in the interior of Australia.

Lotus (*Nelumbium speciosum*). Although this has been said to be the Sacred Lotus of the Egyptians, there seems some doubt as to its identification It is abundant in India, where its rhizomat stems are used for food, but more so in

China, where it is extensively cultivated. It is held sacred by the Hindoos, who prepare a kind of wick from the spiral vessels of the leafstalk for burning before their idols. The flowers are generally finely tinged with pink, but there is a variety with white flowers.

Nelumbium Caspicum, a native of the regions of the Caspian, is probably only a variety; as also *N. luteum*, a native of Jamaica, the Malay Islands, and parts of the American continent, differing only in the colour of their flowers being yellow. All have large showy flowers, and are cultivated at Kew. Their leaves have the curious property of repelling water, which runs off of them like quicksilver.

In alliance with the two preceding families are the water-shields, *Cabombaceæ*, consisting of 2 species of *Cabomba*, natives of North America, and *Hydropeltis purpurea*, a plant of wide geographical range, being found in North America, Himalayas and Australia. They are water-plants with small shield-like floating leaves, and finely-cut submerged ones. They differ from *Nymphæaceæ* and *Nelumbiaceæ* in their flowers being small and axillary.

ADDITIONS AND CORRECTIONS.

PAGE 28, line 8 from bottom, *for* "lily" *read* "Amaryllid."

Page 32, line 8, *for* "sabulare" *read* "Tabulæforme."

Page 46, line 2, *omit* "pea."

Page 87, line 7, *for* "1846" *read* "1853."

Page 112, before "The Ringless Fern Family" *read paragraph on next page commencing* "Ferns rank as one of the widest."

Page 137, after 2nd line, *add:* "About 70 species have, by some botanists, been separated from this as a distinct family, under the name of Orontiaceæ. In Europe it is represented by Calla palustris and Acorus Calamus (the sweet flag), a native of this country. The rhizome of the first is mealy, and in Lapland is used as food. The rhizome of the latter, and also its sword-shaped leaves, are highly aromatic; it is used in perfumery, and has some medicinal reputation."

Page 140, line 9, *for* "succulent" *read* "circular."

Page 143, after line 4, *add:* "It is not sufficiently hardy to withstand the severity of winter in this country. The only hardy fan-palm known is Chamærops Fortuni, a native of China, introduced about 25 years ago."

Page 174, line 6 from bottom, *for* "produces" *read* "furnish."

Page 223, *for* "Dichlamyds" *read* "Monochlamyds."

Page 278, line 19, *for* "Dr. Boyle" *read* "Dr. Royle."

Page 369, after "pot pourris," in line 6 from bottom, *add:* "They are also used in the preparation of Eau de Cologne."

Page 421, line 12, *after* "which" *add* "with other ingredients."

Page 425, *for* "Red Sandalwood" *read* "Red Saunder'swood."

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